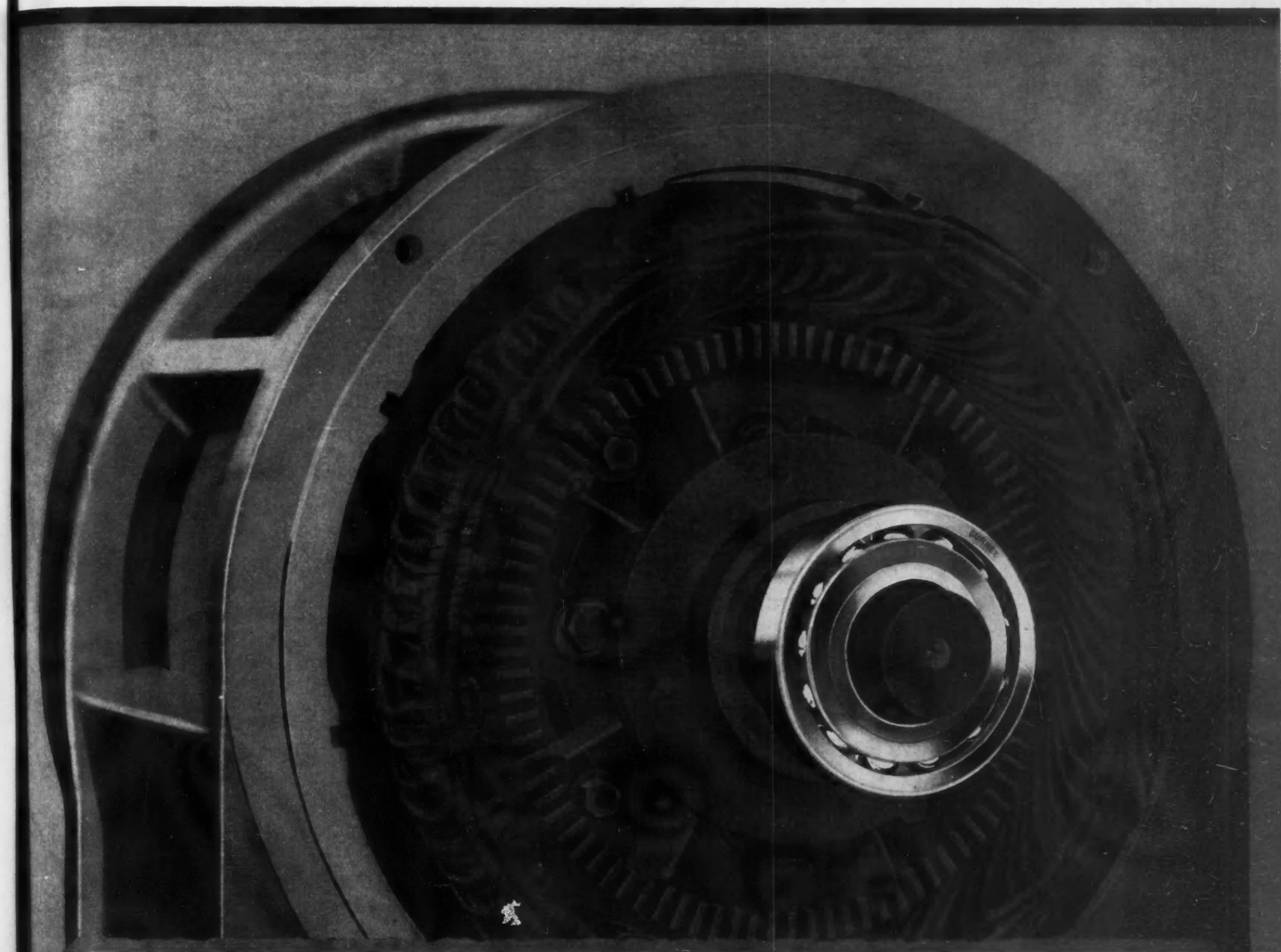
Advantages of Electrified Rolling Mills—Attitude of Machine Tool Makers to Motor Drive—and the regular departments

Engineering Library

Electrical World

New York, November 24, 1917 McGraw-Hill Publishing Co., Inc. Vol. 70, No. 21 10c a copy



Modern Motors and Generators are Equipped with

GURNEY

BALL BEARINGS

SPECIFY GURNEY BEARINGS FOR YOUR MOTORS

CAPACITY GURNEY ENDURANCE

GURNEY BALL BEARING CO.

Conrad Patent Licensee

JAMESTOWN, N. Y.

Weston

For Maximum Efficiency Look to the Specialist

No individual or organization, devoting its energies to many different purposes, can equal in each instance the results attained by the specialist who masters one particular subject and hence becomes an expert.

So, in the field of Electrical Measurement, there are not and never have been any Indicating Instruments to compare with

Weston

Portable and Switchboard

INDICATING INSTRUMENTS

For A.C. and D.C. Circuits

From the very beginning to the present, practically every improvement in the Art of Electrical Measurement as it is known today has originated with this Company. To convince yourself of Weston superiority, you have only to compare the interior of any Weston Instrument with any instrument of other make. In accuracy, in serviceability, in durability, in legibility, Weston Instruments far surpass all others.

No Engineer, when considering switchboard equipment, can afford to allow any considerations to prevent his specifying Weston Indicating Instruments. Whoever supplies the balance of the equipment, Weston Instruments should be specified.

You owe it to yourself to become posted regarding the vast superiority of these Weston Instruments. Write us for any special information or ask for the Bulletin or Catalog describing any group, A. C. or D. C., Switchboard or Portable, which interests you.

New York
Boston
Philadelphia
Pittsburgh
Buffalo
Richmond
Cincinnati
Cleveland
St. Louis
Chicago
Detroit

Home Office and Factory
13 Weston Avenue
Waverly Park, Newark, N. J.

Denver
San Francisco
Toronto
Montreal
Winnipeg
Johannesburg, S. Africa
Vancouver
London
Petrograd
Paris
Florence

Weston Electrical Instrument Co

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER and AMERICAN ELECTRICIAN
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 70 NEW YORK, SATURDAY, NOVEMBER 24, 1917 No. 21

Is This My Boy?

WE HAVE put our young men in arms and we have a large task to see that they get what they need. While they are in Europe they have a right to know that we at home are not slacking in the earnest, unflagging determination to see the war through. In this task all must co-operate. Those who are not at the front are as necessary a part of the supporting nation in arms as if they faced the life and death of the trenches. It is a safer part, to be sure, but it is nevertheless a part. Let us not forget that. No matter what our situation in life, we must all work together for victory, and victory cannot be secured without sacrifice. Moreover, this sacrifice is personal and cannot be passed on. The obligation rests on all alike and not on any particular class. To visualize the close tie between trench warfare and the industrial trials at home, the publishers of the ELECTRICAL WORLD send with this issue a supplement which tells its own story. It is a message to business and also to labor. Each should contemplate the lad in the trench and ask himself what his fate shall be. Shall he die game with an empty musket and an empty stomach while capital and labor squabble for advantage and fight for the last cent of profit or wages, or shall he be inspired and encouraged with the thought that here at home all are working harmoniously, industriously and unselfishly for the common cause?

The Suppression of Electric Signs

IT HAS been fairly evident for some little time past that general efforts directed toward the saving of fuel must end in the abandonment to a considerable extent of the flamboyant electric signs which are so conspicuous in the average city. The natural course of events would have been a gradual disappearance of these as a matter of personal conservation and economy on the part of those who use them. The general pressure should ordinarily be sufficient without specially directed efforts. Now, however, the Fuel Administrator has definitely restricted the use of electricity for signs by regulations going into effect on Nov. 15, as reported fully in our issue of last week. How great a saving of fuel can be thus accomplished remains to be seen, for electric signs do not demand energy at all commensurate with their conspicuousness; but in the aggregate the results may be considerable. The most important feature of the matter, however, is that manufacturing conditions are more than likely to demand all the energy which can be saved on the signs. We cannot look forward to an actual material diminution in the amount of electricity used, but rather to a shifting of the demand from comparatively needless things to those which have definite public usefulness.

The present prohibition, too, is by no means absolute. It does not apply to public lighting of any kind nor to the maintenance even of signs within certain restricted hours, from 7.45 to 11 p. m. in the case of signs in general, and from half an hour after sunset to 11 p. m. in the case of simple announcement signs. The gross effect, therefore, of the restrictions on the actual demand for energy will be considerably lessened, but the sign business will be thrown considerably off the peak, thereby permitting a freer use of electric power without difficulties caused by lap load. From this standpoint the effect on generating companies will be rather salutary, since these are difficult days in which to obtain additional equipment. The companies therefore, while losing some revenue from signs, are very likely to recoup themselves handsomely in industrial lighting and power work.

In all these efforts at fuel conservation it must be borne in mind that the difficulty to be met lies not so much in the actual lack of the fundamental supply of coal as in the burdens that its transportation entails and in the necessity for using for the navy in particular large quantities of fuel of the very grades which have customarily been popular with electric supply companies. The chief difficulty is in the transportation, and therefore the necessity for limiting the fuel as closely as possible to necessary industrial purposes is sufficiently evident. From a practical standpoint we do not believe that the present restrictions are going to have any serious effect whatever on the supply companies other than the inconvenience due to a shift in the incidence of demand from one class of users to another. And, as the proportion of industrial power and lighting grows, by just so much more will the obligation rest on the Fuel Administrator to see to it that the coal supply is kept up.

Financing Abnormal Cost in Extensions

EXTENSIONS of central station service in these days mean a twofold problem. Part of the problem arises from inflated cost and abnormal scarcity of materials and labor; part of it is due to usurious rates for capital, which is almost as scarce as hens' teeth. If materials, labor and capital are to be had, they are to be had only under conditions gravely altered by the world upheaval. The present is enough to guide us; the future we cannot foretell, but from the immediate trend of events it is plain that we may soon be at the point

where for every effort of labor, for every pound of material, for every dollar of investment, we shall have to show a purpose connected with stern war.

These are not ordinary times and they call for extraordinary measures. The central station cannot make extensions without calculating cost. Labor and material cost is very high, and it may be double the normal figure. Neither can the company provide new facilities without cold cash to finance them. The cost of money runs away above the usual percentage. It is under these circumstances that the Cleveland Electric Illuminating Company has introduced the form of prepayment contract for commercial loads in excess of 5-kw. capacity which is published elsewhere in this issue. In effect, it leaves the responsibility of raising capital for a new extension to the customer. Necessarily in such a form of contract it is not feasible to cover all of the items of abnormal cost. Some extra cost will be experienced in feeders, subway and increase in plant capacity which the company will have to contend for in any future valuation. This part of the cost the company will meet. In general, however, the contract provides that the customer shall advance the capital for the construction which is specifically an extension to render service to him. It differentiates between the necessary outlay under present critical conditions and the estimated normal cost as of 1914. The customer advances the full outlay, but he receives a refund of what the work would have cost at 1914 prices. The central station company keeps the balance, representing abnormal cost, so as to protect its property values. The customer pays an abnormal cost to get a construction job done in abnormal times, and his expense in so doing is part of his manufacturing cost.

With the property investment thus restricted on its books to a figure which regulating commissions and courts can never question, the utility can base its rate for service on the new extension according to its rate for like service on the old lines. The utility can make rates based on pure operating cost if it continues static; it would be under an urgent incentive to make higher rates if it should enlarge capital account by the present full high cost of materials, labor and money. The Cleveland company protects its market for service on the new line constructed under the plan by returning the normal cost advanced by the customer so that he receives it in annual installments during a period of ten years. It furnishes service, but it holds out no bright prospect for a mushroom plant with an exigent war order to sign a power contract with a glad hand and skip the community without ceremony at some early day.

As an emergency measure, justified by the clear necessities of grim days, the solution which has been developed with care by the Cleveland company is reasonable and just. We believe that the public service commissions generally have a keen understanding of the emergency requirements of the times and that they will not let central stations be overburdened with service extensions calling for heavy financial outlays to unbalance their accounts. With the return of normal times the issues will be on a different footing again, but in the meanwhile the problems loom large, they are vital to the maintenance of the properties on a sound financial foundation, and they have to be coped with by special methods as in this case.

Motor-Driven Tools

PROFESSOR CLEWELL'S discussion of motor drive for machine tools gives an admirable conspective view of the present development of the art. By consolidating the views of ten representative toolmakers he has brought the situation clearly into the foreground, and it is surprisingly favorable to the general use of electricity. The use of motors has steadily increased with the improvement of their applications and the general availability of electric power until to-day the majority of new equipment of the heavier sort is fitted for motor drive. Its fundamental advantages of convenience, efficiency, flexibility and exact speed control are well known. The objections on the score of high first cost, the price of power and the conservatism that clings to old methods have been steadily fading from view. From now on, as new shops are equipped, the motor is surely coming into its own. Heretofore there have been the inconvenience of changing over machines for individual drive and the natural objection to scrapping equipment in good condition. Moreover, in an old shop fully organized for belt drive many of the characteristic advantages of motors cannot be fully realized. In starting afresh the whole layout of the shop can be planned for maximum efficiency without having to consider the necessities of arrangement from the viewpoint of the transmission of power by belts and shafts.

Speaking broadly, a machine in which the item of power consumption is a considerable one in the cost of product should be individually motor-driven merely on account of the increased efficiency. If, as very commonly happens, exact speed control exercises an important influence on its rate of output—that is, on the working efficiency of the operative—individual drive with its complete power of speed control is doubly necessary. Only with light machines steadily worked in groups at fairly uniform output can group driving be really advantageous. It is the working unit, whether of one or half a dozen machines, that must be considered. At the present moment the amount and character of overtime work is a peculiarly important item. With individual drive certain combinations of machine tools necessary to production can be made at will without reduction of efficiency from the power standpoint, while with belt and shaft drive as generally found full efficiency can be obtained only when the plant is in full operation. Most important of all, however, is the influence of individual motor drive on shop layout and working organization. When every machine has its own separate motor, not only can the plant be kept more clearly and better lighted, but it can be arranged for the highest efficiency of production irrespective of all considerations of power supply. Machines can be

grouped and placed so as to insure the minimum of backlash in that steady movement of materials, processes and finished work that is so necessary to high output at a minimum cost.

Mere saving of time due to speed and ease of control and to the placing of machines so as to call for the least human effort in handling the work is no small practical item of gain. Likewise, the abolition of shafting, belting and all overhead gear leaves the space clear for the cranes and travelers needed for the easy transference of heavy products without interference with the floor space and often with the workers as well. In fact, it is these operative advantages, quite aside from the saving of power, that constitute the strongest reason for going to individual motor drive in all new installations. Maximum output of machines, minimum waste of human power and time—these are the watchwords of American industry, doubly forceful in the stress of war production.

Conservation of Small Water Powers

IN THE present exigency every pound of coal that can be saved by whatever means is clear gain. The necessary industries of the country require so large a supply and the transportation facilities are so taxed that every effort ought to be made, and made at once, to utilize the country's water powers to the fullest extent. It is not that the general public is going to suffer from personal lack of fuel, nor that disaster is going to overwhelm any industries. There is coal enough and transportation enough to prevent any such unhappy results, provided that each is wisely utilized; but the difficulties of getting coal, to say nothing of its cost, are going to be serious enough to make transmitted power more than ever desirable as a relief to the fuel situation. The ordinary course of events in developing hydraulic privileges has been the organization of a utility company, the development of the privilege, and the building of a more or less extensive network of transmission lines to deliver the power to various customers. This in the last resort means that a bond issue must be floated to finance the proposition, and that the owners must go for help to the bankers as general custodians of the world's money.

In their turn the bankers, assuming the enterprise to be one sound enough to appeal to their business sagacity, are chiefly interested, not in the technical details of the work nor in its ultimate relation to the fuel supply, but merely in the prompt, successful and profitable handling of that bond issue. The bigger the better from the banker's standpoint so long as there is clear and definite prospect that the interest will always be paid. Now, it is as much, if not more, trouble to float a small issue of bonds as a fairly big one, and the practical result of our methods of financing has been that the small water powers have gone begging and have remained to this day undeveloped. They are not propositions which can be easily financed, while if they fall into the hands of some one who can personally reach the capital with which to develop them they often turn out to be excellent properties. Small powers, too, are handicapped in another way, in that unless some local electric lighting company looks to them for service they cannot dispense their goods freely to the public and are likely to become mere appurtenances to some particular manufacturing concern. Just now the main consideration is that the small powers should be worked for all they are worth. A little stream that can find enough storage to assure even 100 hp. ten hours a day for manufacturing work is right then and there saving fuel at the rate of something like 700 tons a year and thereby doing sterling service to the cause of conservation.

The costs of operation in such cases are very small. The plant is practically a one-man affair and the chief expense is in the necessary capital charges. Under these circumstances it would seem wise for the commissions and other regulating bodies to take cognizance of the value of small plants and to realize that there is a public exigency which demands their encouragement even to the extent of allowing them to sell to all comers up to the limit of their capacity, a step which is not ordinarily considered good public policy, since existing plants are glad to pick up and utilize water powers, although sometimes the same regulating bodies are loath to permit the necessary increase in securities. Now, when fuel is scarce and many a station likely to be greatly inconvenienced in getting its coal supply, would seem to be a good time to loosen up restrictions all along the line and to use public authority so far as may be to encourage the utilization of every bit of water power which can be reached—by existing plants if practicable, but utilization in any case. We could mention a good many small privileges which have been employed to good advantage, and the example which they have set ought to be followed promptly. The task naturally falls to the lot of companies now operating, but the main thing is to see that it is accomplished as soon as feasible by whosoever will undertake it.

The Coming Issues

WHILE the advantages of individual motor drive for large machine tools are generally conceded, there are differences of opinion concerning the wisdom of such an investment for medium or small-sized machinery. In the next issue of the ELECTRICAL WORLD Prof. C. E. Clewell will discuss this subject, basing his conclusions on the merits of each case. He will point to other economies than energy saving due to elimination of line shafting and belting which should determine the policy to follow in any given instance. In addition to this discussion, there will be an article on a hydroelectric plant in which all of the operations of starting, stopping and switching are performed automatically, an attendant visiting the plant only once every eight hours. There will also be discussed in the next issue questions of public relations and of inter-trade relations, besides the regular statistics of the central station industry, which, despite many handicaps, is enjoying unprecedented business.

Attitude of Machine-Tool Builders to Motor Drive

Collected Opinions of Ten Typical Manufacturers Are Uniformly Favorable Toward Electric Drive—Nineteen Advantages of Individual Motor Drive Compared with Line-Shaft Drive

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

SYNOPSIS.—This article summarizes in a broad general way some of the recent tendencies in machine-tool design which have been brought about, in part at least, by the growing use of motor drive, particularly in the larger types of machinery. The article is based on a number of individual opinions expressed by machine-tool manufacturers either favorable or unfavorable to the wide use of motor-driven appliances. In order to make these opinions definite and comparable, a number of typical questions were addressed to representative machine-tool firms and a digest of the answers has been included in the article. Special attention is directed to the list of advantages of motor-driven machinery over line shafting or group drive according to a representative of one of the leading machine-tool manufacturers. This list is particularly interesting because it presents the case from the standpoint of the machine-tool builder rather than that of the motor manufacturer, and the article as a whole is unique in the emphasis it places on the viewpoint of the former rather than the latter.

THERE are essentially three viewpoints to the motor application problem: (1) that of the motor manufacturer, who quite naturally views the whole situation in a way favorable to the widespread use of motors; (2) that of the machine-tool builder, who is more liable to be unbiased in his attitude toward motor and line-shaft driving and whose opinion is determined partly by the advantages in the use of the motor, partly by the demands of the trade, and partly, of course, by the experience of the machinery manufacturers in their own plants with motor-driven machine tools in comparison with line shafting and belting; (3) that of the user of machinery, whose choice and preference in turn are governed to a considerable extent by what types of machine-tool drives are available and also in some cases by the information received from the motor manufacturers.

Taken as a whole, therefore, it is reasonable to assume that the viewpoint of the second group—that is to say, the machine-tool manufacturers—if based on information from a sufficiently large number of firms, will probably form a better basis for conclusions as to the present status of motor-driven machinery than information from any other available channel. In this connection it is only fair to say that the various motor manufacturers because of their study in this field possess a remarkable accumulation of data on which to base accurate conclusions.

BASIS OF THE OPINIONS

In order to reduce the various opinions of representative machine-tool manufacturers to a comparable basis, and also partly for the purpose of securing tangible replies from these firms, definite questions were sent to a number of representative machine-tool manufacturers. The answers which were received and which are condensed and grouped in the following paragraphs form an interesting and instructive commentary on the present attitude of these firms to the motor problem. In a general manner they may be taken as an indication of what may be expected in the way of developments in this field in the near future as far as a more uniform policy in the application of motors is concerned for the various classes of machinery employed for industrial purposes.

ATTITUDES OF DIFFERENT COMPANIES TOWARD MOTOR DRIVE

(1) *Lodge & Shipley.*—In general group drive is preferred to individual drive except in cases where a few machines are run on overtime or at night and for the reversing control of planers and where crane operation is facilitated by the elimination of overhead shafting.

(2) *Ingersoll Milling Machine Company.*—Individual motor drive is preferred.

(3) *Jones & Lamson.*—The tendency is strongly toward motor-driven machinery, motors being used practically always on heavy machinery and, where conditions permit, also on lighter lathes, drill presses and the like.

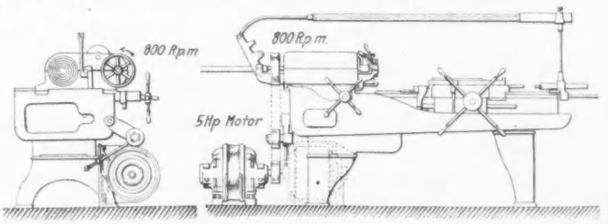


FIG. 1—FLAT-TURRET LATHE WITH TWO METHODS OF MOUNTING MOTOR (ON FLOOR AND ON LEG)

(4) *Cincinnati Bickford Tool Company.*—Not much choice is expressed between a speed box and a variable-speed motor for standard tools. For special schemes of mounting the motor (Fig. 9) motor drive is preferable.

(5) *International Machine Tool Company.*—Individual motor drive is preferred to any other method of drive.

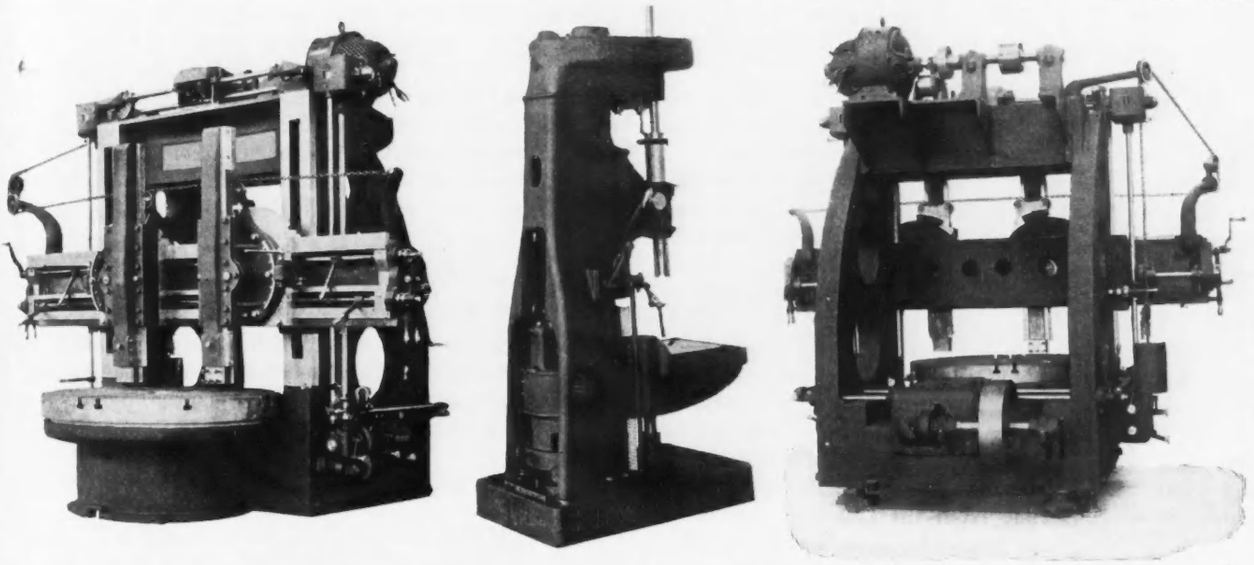
(6) *Bridgeford Machine Tool Works.*—Individual motor drive is preferred for machine tools requiring 20 hp. or more, group drive for machines which require not more than 5 hp. or 6 hp. All machines that are made by this company and have gear heads are heavy-duty, requiring 10 hp. to 15 hp. In 95 per cent of the cases involving these machines motor drive is specified. Very few geared-head machines are belt-driven.

(7) *Cincinnati Planer Company.*—Wherever possible, electrically driven tools are favored.

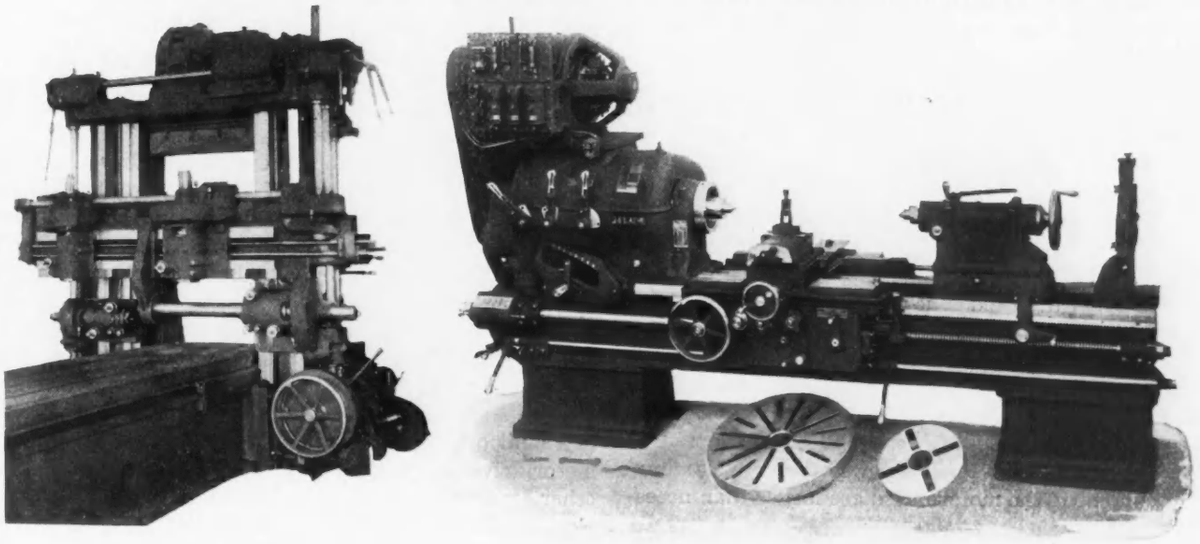
(8) *Bausch Machine Tool Company.*—Favorable to motor-driven machinery.

(9) *Foster Machine Company.*—About 80 per cent of the machine tools in this company's plants are individually motor-driven.

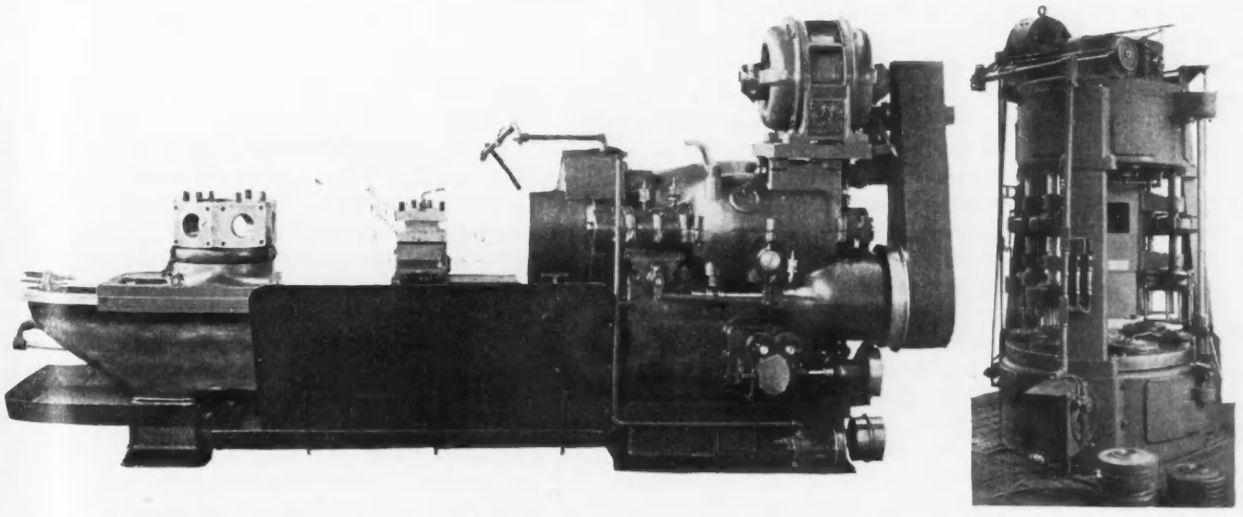
(10) *American Tool Works Company.*—The preference of this company for motor-driven or belt-driven



FIGS. 2, 3 AND 4—BORING MILL WITH MOTOR WHICH RAISES AND LOWERS CROSS RAIL AND DRIVES RAPID-POWER REVERSE; STATIONARY-HEAD DRILLING MACHINE WITH VERTICAL-SHAFT MOTOR; REAR VIEW OF MACHINE IN FIG. 2



FIGS. 5 AND 6—PLANER WITH MOTOR AWAY FROM DIRT AND POSSIBLE INJURY; LATHE ARRANGED FOR BELTED MOTOR DRIVE AND PUSH-BUTTON CONTROL



FIGS. 7 AND 8—LATHE DRIVEN BY MOTOR THROUGH BELT; MOTOR-DRIVEN FLYWHEEL DRILLING MACHINE

machine tools is influenced entirely by the conditions under which these tools are to be operated. Both types of machines are handled and each has a legitimate field of operation.

The machine-tool manufacturers giving the preceding opinions have not been selected because of any known attitude (either favorable or unfavorable) to the problem of motor applications; their names have merely been taken at random from a large list of possible firms from which answers might have been solicited. On such a basis the trend of the opinions expressed may probably be taken to indicate fairly the average opinion of the majority.

It will be noted that these ten opinions point almost uniformly to an attitude favorable to electric power for machine-tool work. About three and a half years ago (in 1914) the writer addressed a somewhat similar query to leading manufacturers of machine tools, and there was a noticeable difference in the opinions expressed at that time from the trend of opinion as outlined above. This seems to show a growing tendency toward a more and more favorable attitude concerning motors for machinery drives, which in turn seems to indicate that the well-directed efforts of the motor manufacturers to this end are now beginning to find widespread acceptance in the machinery field.

Superiority* of Motor-Driven Tools to Line-Shaft-Driven Apparatus

(1) See the list† of advantages for motor-driven machines as given at the end of this article.

(2) Individual motor drive best for machine tools of large size (10 hp. to 75 hp.); can be mounted on top of the machine as in Fig. 5, thus being out of the way and protected from dirt and other injury.

(3) Advantages: extreme flexibility of equipment, a lighter and cleaner shop, less trouble with upkeep. Disadvantages: slightly increased first cost, complicated mechanical attachments for direct driving when the design of the machine tool has not been adapted to motor drive, possibility of low power factor with alternating current if the motors used are larger than necessary.

(4) Number of working parts in the transmission reduced, speeds changed readily.

(5) Machine can be operated individually regardless of whether other machines or line shafts are running or not; the machine can be shut down and the power stopped independently of other machines; individual motor drive is more serviceable than other methods.

(6) For large machines individual motors are preferred, but no specific reasons are given.

(7) Eliminates the upkeep and cost of belting, line shaft and pulley and the time consumed in oiling; does away with the objectionable feature of obstructing the light by overhead construction, and a greater number of speeds is possible with less complication.

(8) Economy in energy, space and material.

(9) For such special cases as single-pulley drive with screw machines or turret lathes, heavy planers and boring mills the first cost of individual motor drive is less, but only for such tools as have been designed for either method of driving. Greater flexibility is produced with individual motor drive, which may contribute to a higher total factory efficiency.

(10) Constancy of power input, no belt slipping, adaptability of the machine to overtime work, freedom from dependency on the rest of the shop, and in some cases greater convenience in control. The choice should be governed by the circumstances under which the machines are to be operated.

Approximate Percentages of Output Supplied for Individual Motor Drive, Group Electric Drive and Straight Line-Shaft Drive

(1) Machinery for new shops in large majority of cases is for individual motor drive. About 36 per cent of total product is equipped for motor drive. No figures on group or straight line-shaft drive percentages.

(2) Very few machines furnished for belt drive. (See Fig. 5.)

(3) About 50 per cent at least for individual motor drive. Practically all the rest for group drive.

(4) Smaller machines, 10 to 15 per cent motor-driven; medium-sized machines, 30 to 40 per cent, and for the larger machines, 60 to 75 per cent. No percentages available for group and line-shaft drives.

(5) About 55 per cent, particularly in the larger sizes, are arranged for motor drive. No figures on group and line-shaft drive.

(6) Approximately 95 per cent motor-driven.

(7) About 60 per cent of planers are belt-driven either by line shaft or group drives and about 40 per cent are individually motor-driven. About 85 per cent of boring mills are for individual motor drive and about 15 per cent for belt drive.

(8) About 50 per cent for individual motor drive.

(9) About 5 per cent of the screw machines and turret lathes are supplied for individual motor drive.

(10) Majority of lathes above 30 in. (76.2 cm.) and of radial drills above 5 in. (12.7 cm.) are individually motor-driven. Practically all the very large tools of other manufacturers are individually motor-driven. For small lathes (14, 16 and 18 in.—35.4, 40.6 and 45.6 cm.) and small radial drills (2, 3 and 3½ in.—5.1, 7.6 and 8.9 cm.) belt drive is preferred, although some are arranged for individual motor drive.

Recent Changes in Machine Tools Adapting Them Specifically to Motor Drive

(1) The selective head lathe (see Fig. 6) of this company has been developed during the period when the demand for the motor-driven machine tool has come, and hence it has been natural for the motor drive to be a consideration in its development.

(2) The tendency of this company's design is for electric drive and moreover for constant-speed work so as to accommodate alternating-current motors from stock.

(3) Four twelve years the flat-turret lathe made by this company has been so designed as to require no additional attachments for constant-speed motor drive. Two ways of mounting the motors are shown in Fig. 1, in the first case the motor being mounted on the floor and in the second case on a "motor leg."

(4) Some interesting cases of recent designs for electric drive by this company are shown in Figs. 3 and

*The opinions on this subject and the following ones are arranged in the same order as those for the first subject; that is to say, opinion (1) refers to Lodge & Shipley, opinion (2) to the Ingersoll Milling Machine Company, etc.

†This list was submitted by E. E. George, plant engineer, Lodge & Shipley, expressly for use in the present article.

10 and are described in the captions under the illustrations.

(5) No changes have been made in the motor-drive arrangements employed by this company, as the lathe was originally designed for individual motor drive and it has been very satisfactory. (See Fig. 7.)

(6) This company's output has always been a heavy-duty geared-head line of machines especially adapted to motor drive, and hence no radical changes have been made during the last ten years.

(7) The smaller planers are arranged so that motor brackets can be attached to the housings at any time and the larger planers can be changed to reversible motor drive at any time. All boring mills are arranged so that a motor can be attached at any time. An example of the latter is shown in Figs. 2 and 4.

(8) No recent changes in machine tools to adapt them specifically to motor drive. (See Fig. 8.)

(9) The machines made by this company in general lend themselves very readily to individual motor drive.

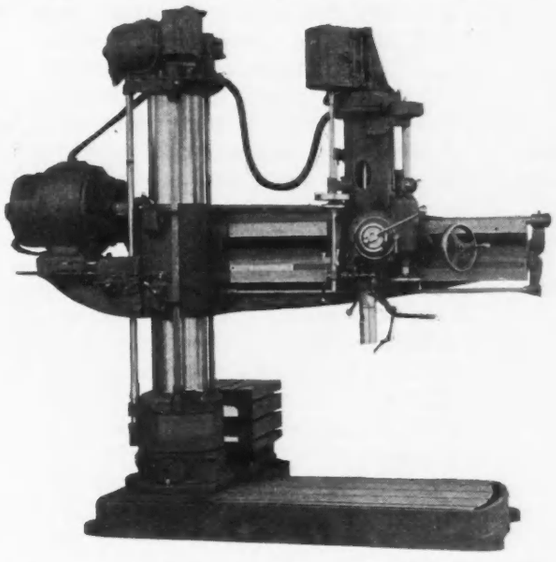


FIG. 9—RADIAL DRILL WITH SEPARATE MOTORS FOR DIFFERENT OPERATIONS

(10) The machines of this company when originally designed took motor drive into consideration. On the geared-head lathes there is a planed surface on top of head-stock on which the motor plate may be mounted.

LIST OF ADVANTAGES OF INDIVIDUAL MOTOR DRIVE

The following list of advantages of individual motor drive in comparison with line-shafting or group driving is presented from the standpoint of a representative machine-tool manufacturer as a supplement to the preceding opinions. On this basis the points favoring the individually motor-driven machine have a peculiar significance and become of unusual interest to the motor manufacturer, while they constitute an excellent statement of the problem as it is viewed at this time.

(1) The maintenance of motor equipment is much less than that of counter-shafting, line-shafting and belting for the same number of machines.

(2) The initial cost of motor equipment is less than that of equally satisfactory counter-shafting and line-shafting. The only type equipment that will give as good service as a motor drive is that with ball-bearing hangers, clutches and loose pulleys.

(3) The power losses in an individual motor drive are much less than in the average counter-shaft.

(4) A motor-drive machine can be set up and moved much more quickly.

(5) It can be moved around the shop from one location to another in about one-third of the time.

(6) It can be started and stopped much more quickly and safely, particularly if an automatic starter with dynamic braking is used.

(7) Much finer speed control can be secured with a rheostat than with a gear-changing device.

(8) Reversing with a motor controller is much simpler than by mechanical device.

(9) Special control is available as required for reversing planers, slotters, boring mills, etc.

(10) There is clearance overhead so that cranes and hoists can be used for loading and unloading machine. It is very difficult to arrange any sort of crane for a belt-driven machine.

(11) Better lighting is secured in the shop by the absence of belts and counter-shafts.

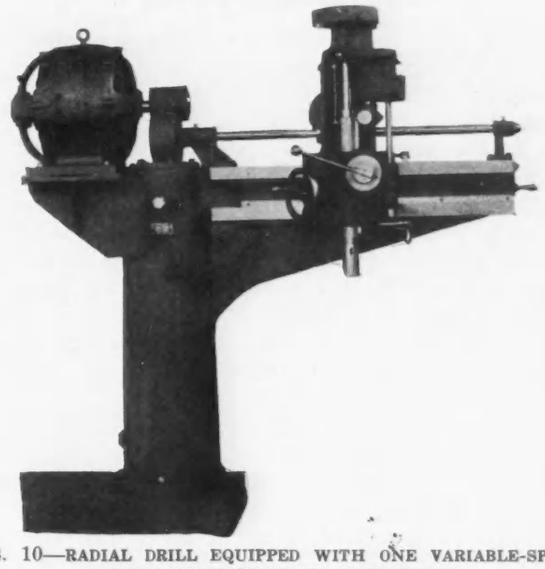


FIG. 10—RADIAL DRILL EQUIPPED WITH ONE VARIABLE-SPEED MOTOR PERFORMING ALL OPERATIONS

(12) Machine can be set at any angle to suit bar stock.

(13) The machine can be arranged to suit the space requirements of the machine and any counter-shaft.

(14) The machine can be much better balanced by an end-to-end coupling of the machine spindle to the motor than by using a belt with the consequent side pull and unbalance.

(15) Sliding contacts or flexible cable can be used instead of having belt move over a drum, as in designing grinding machinery.

(16) The machine can be designed for its best speed, regardless of all other machines. In laying out line-shaft and group drives it is difficult to secure a speed that will be applicable to the various makes and sizes of machines.

(17) Machine can be protected against overload by fuses or circuit breakers.

(18) It can be protected against shock due to a tool sticking or any other accident by the use of quick-action circuit breakers.

(19) Safety devices are very easily applied to a motor-drive machine.

Advantages of Electrified Rolling Mills

Considerations That It Is Necessary to Keep in Mind in Selecting Drive—Comparative Costs and Performance of Different Types, and Useful Information on Power Requirements

BY WILLIAM KNIGHT
Assistant Mechanical Engineer Crocker-Wheeler Company

A TREMENDOUS volume of manufacturing production has been the outstanding feature of the last few years, and the steel mills in this country as well as in Europe have played no small part in contributing their share to the enormous amount of work done. The trend of evolution of power supply in iron and steel plants has been to electrify every machine up to and including the main rolls, owing to the greater flexibility of operation and control of the electrical machine as compared with the steam engine.

The Important Factors

Among other factors which must receive consideration in the electrification of the steel mills are the following: First of all is efficiency. There is no doubt that in an electrically driven rolling mill the cost of the power can be conveniently controlled by using the most suitable arrangement in the electrical plant. Furthermore, the elimination of the losses in the boiler room and all along a steam pipe line which is made possible by buying the power from an outside source will still further reduce the cost of operation per ton rolled. The output of an electrically driven rolling mill is also larger than it would be with steam drive, owing to the rapidity with which the mill can be controlled and handled and the uniform torque exerted by electrical motors equipped with flywheels to carry them over peak loads.

The economy of space that can be effected by buying electricity from an outside power station instead of installing a steam-power plant in the works, and the possibility of measuring very accurately the amount of power needed for rolling a given section (thus allowing a very close estimate of the manufacturing cost of any product), are the two points that, in these days of high cost of land and keen competition, speak strongly in favor of electric drive in rolling mills.

It need hardly be said that in a rolling mill the demand of power generally varies rapidly between wide limits. When the ingot enters the rolls a large demand of power occurs, and as soon as it leaves the rolls the power demand may suddenly be reduced to that required for overcoming the friction losses in the mill itself and in the motor only. This rapid fluctuation of power which occurs during the operation of a rolling mill, if not corrected somehow, will create a very unfavorable condition for rolling at the lowest price, since this price is contingent on the condition that the power demand should be, as much as possible, maintained steadily at the full capacity of the generating plant. To meet this requirement, however, in some cases may mean an increase in capital cost and a large increase in friction losses which may not be offset by the saving effected by obtaining the power at a lower price.

The operation of a rolling mill, like any other engineering problem, is a commercial proposition aiming at the largest possible production obtained with the least expense, so that the best results are reached through a compromise between the advantages and the disadvantages arising from several general and local conditions, the maximum over-all economy being reached when the combined total capital charges and running expenses per ton rolled become a minimum.

For instance, it is generally agreed that the maintenance expense for an electrical installation is lower than that of a steam plant, but where gas can be obtained at a low price it is readily seen that electricity has a formidable rival. In Germany, for instance, the "uniflow" engine has in many places been used with good results for small direct rolling-mill drives in preference to electrical drives, doing away with the conversion of mechanical into electrical power in the central station and back again into mechanical at the mill.

Steam Versus Electric Drive

Before deciding whether to adopt a steam engine or an electric drive for a rolling mill the following points must be considered: (1) capital outlay; (2) steady losses; (3) saving effected with electrical motors during reversal, in the case of reversing rolling mills; (4) power absorbed with partial load; (5) speed of mill as affecting production; (6) if the power is generated within the works, what investment or operating expense it involves, or if it is purchased from a public service corporation, under what conditions the purchase can be made.

In many steel plants the waste gas from the blast furnace may be used for generating the needed power. If the surplus of such waste gases is large enough, there is little doubt that it will be cheaper to generate the power inside of the works than to buy it from an outside generating plant. In plants which are purely rolling mills, where there are no blasting furnaces in operation, and in small plants which do not have a very large production, the local generation of the power would not be in the majority of cases a sound economical policy, as advantages are usually derived by means of purchasing the power from an outside source.

When figures on the paper show that local generation of power would be cheaper than purchased power, the fact should be taken into account that the only object of a public service corporation is to sell energy and that, in order to accomplish this purpose, the combined efforts of a staff of specialists are used in the production of a reliable source of power at the lowest price. In a steel plant, instead, the main object is to produce steel, and the production of power is only a side issue which, generally speaking, could not be handled as efficiently and economically as if the power were produced by a concern established for that purpose only.

The load factor of a central station supplying energy to a steel mill increases with the magnitude of the plant. With small plants, however, the load factor is larger than would be expected, owing to the fact that the rolling is generally done in multi-stand mills and a larger number of passes are taken to produce a desired section. Also, in many mills, several pieces are rolled at the same time, the result being a more uniform load with multi-stand mills than with the large single-stand mill. The load factor is an important item and affects a good deal the cost of the power.

TABLE I—DATA ON PLANTS USING ILGNER SYSTEM*

Type of Mill	Work Done	Mill Motor, Direct-Coupled			Flywheel Motor-Generator Set			Additional Information
		Normal Output, Hp.	Maximum Speed, R.p.m.	Maximum Torque, R.p.m.	Maximum Speed, R.p.m.	Motor Output, Hp.	Flywheel Weight, Tons	
34½-in. three-high mill with three stands of rolls	Rolling heavy beams	12600	180	70	428	2,600	55	
29½-in. mill with three stands of rolls	Rolling beams and light rails	8,400	180	62	428	1,500	55	
29½-in. mill with five stands of rolls	Rolling beams and rails	7,300	180	52	428	.....	75	Power supplied by a generator attached to an existing flywheel motor-generator set used for another mill.
32½-in. mill with three stands of rolls	Rolling beams, rails and sections	6,000	180	140	500	1,200	50	
22-in. three-high mill with three stands of rolls	Rolling rails, sections and rounds	2,400	.....	120	.....	.....	.....	Power supplied by a generator attached to an existing flywheel motor-generator set used for another mill.
20½-in. three-high roughing mill	Rolling billets	3,800	180	100	.....	.....	.....	Power supplied by a generator attached to an existing flywheel motor-generator set used for another mill.
34-in. reversing blooming mill	Rolling ingots	3,000	70	.....	500	1,800	50	At the Steel Company of Canada's works at Hamilton, Ont.
Reversing blooming mill	Rolling ingots	4,000	75	.....	375	1,800	75	Algoma Steel Company of Sault Ste. Marie, Ont.

*Obtained from several papers presented before the A. I. E. E., the British I. E. E., and the Association of Iron and Steel Electrical Engineers.

How Selection of Equipment Depends on Energy Contract

When energy is charged for on maximum demand the introduction of a flywheel is necessary in order to minimize the load fluctuation and thus obtain the lowest possible rate. When a flat rate is offered there is no need of using an equalizer flywheel for reducing the cost at which the power is purchased. Instead, a motor large enough to take up the peak loads on the mill could be used, thus eliminating the bearing and windage losses of the flywheel. This, however, may be objectionable because of the large size of motor needed. A convenient compromise may be reached by using a comparatively small flywheel and a motor of a convenient size.

In the third case, when peak loads of a long duration only are objected to, a motor of varying speed may be used. In merchant mills it is an advantage, and practically a necessity, to be able to vary the speed of the mill motor. The roughing rolls of a merchant mill must be run at a high speed. The finishing rolls, on the contrary, must be able to run at different speeds, according to the size and the shape of the section being rolled.

With a direct-current power supply this is a comparatively simple matter, the speed variation being obtained by means of field regulation only. With alternating-current motors this requirement is not so easily met, and a serious loss is experienced, since the efficiency of alternating-current motors decreases practically in proportion to the decrease in speed when the regulation is attained by the introduction of resistances in the rotor circuit.

Assuming that the power is transmitted to the rolling mill by alternating current at high pressure, there is no question that induction motors should be used for driving the main rolls. There is, however, a difference of opinion as to whether the so-called auxiliaries should be driven by alternating-current or direct-current motors. This latter point was discussed by B. R. Shover and E. J. Cheney in the London *Electrician* of Oct. 18, 1912, where very careful estimates are published of the capital expenditure and working expenses under the two systems in a certain hypothetical case which is fairly representative of a large mill. The conditions under which the one system or the other is to be preferred and the advantages and disadvantages of both are fully stated. The authors conclude by stating that when the percentage of power required for auxiliary apparatus (exclusive of pumps) is 25 per cent or less of the total power delivered to the mill, and where the power factor of the entire mill, including main and auxiliary apparatus, is more than 70 per cent, the alternating-current system should be used throughout, a saving being thereby effected in working expenses and in the absence of complications.

TABLE II—COMPARISON OF FIRST COSTS OF STEAM AND ELECTRICALLY DRIVEN REVERSING MILLS

(40-In. Blooming Mill Rolling 60,000 Tons of Steel a Month)

ELECTRIC DRIVE WITH PURCHASED POWER	
Complete cost of reversing motor, flywheel motor-generator set, exciters and control equipment	$185,000
Foundations, wiring, etc	10,000
Total	$195,000
ELECTRIC DRIVE WITH POWER GENERATED AT PLANT	
Complete cost of reversing motor, flywheel motor-generator set, exciters and control equipment	$185,000
Foundations, wiring, etc	10,000
Proportion of power house cost, 2500 kw., at $50 per kw.	125,000
Transmission and outside wiring	5,000
Total	$325,000
STEAM DRIVE	
Compound reversing engine	$125,000
Condenser, exhaust piping, including pumps	25,000
Foundations	10,000
Boilers, 2500 hp., including stokers and coal-and-ash-handling plant, at $30 per hp	75,000
Steam piping with covering, valves, etc	15,000
Water tunnel for condenser, with discharge for 8500 gal. of water per minute	50,000
Total	$300,000

If the power is generated within the works, it is always a good policy to install motors which, in case a breakdown should occur in the generating station, could be operated from the plant of a local public service company, thus avoiding serious losses due to interruption of output.

The action of rolling-mill motors may sometimes create a sensible fluctuation in the voltage, thus disturbing the performance of other machinery. To obviate this inconvenience a flywheel of a convenient size may be provided with a suitable arrangement for slip regulation which, by decreasing the speed of the motor, will allow the flywheel to give up enough of its stored energy to make up for the difference between the maximum peak load on the mill and the overload capacity of the motor.

In some cases a flywheel of prohibitive size may be needed for this purpose, and this means large windage and bearing losses that are a constant burden on the cost of production. By increasing the slip of the motor more stored energy can be given up by the flywheel, and a smaller one could be used for the purpose. For instance, with a 10 per cent fall in speed 20 per cent of the energy stored up in the flywheel can be utilized, and with 20 per cent fall in speed 36 per cent of that energy can be used. When 20 per cent speed variation is figured on between no load and double full load (which is about the maximum momentary overload that commercial machines can stand), it does not necessarily follow that this variation will be experienced under actual working conditions, because when the work at the mill is being carried on fairly steadily the power demand never drops to zero, neither does it reach double full-load value except under very exceptional conditions.

CONSIDERATIONS NECESSARY IN APPLYING MOTORS

In many cases, owing to the low speed of the mill and to the high cost of a low-speed motor with good electrical characteristics, a high-speed machine is used and connected to the rolling-mill shaft by means of gears or ropes. When a directly coupled machine is used it is always desirable to use a flexible coupling in order to render less severe the shocks on the motor during the operation of the mill. With either coupled or geared motors the design of the motor bearings must be particularly good if serious troubles are to be avoided. Ropes or gear drives will allow the use of a higher-speed machine, which is both more efficient and less expensive.

The most suitable place to mount the flywheel is on the highest speed shaft, but this arrangement imposes an extra strain on the gears or ropes. To avoid this the flywheel can be mounted on a separate shaft directly geared to the mill. As stated before, by using a larger slip a smaller flywheel can be used for supplying the required amount of energy during the peak loads. However, there is a serious objection against this practice—the increase in cost of production brought about by the reduction of the output of the mill and the drop in the efficiency of the motor, if an alternating-current motor is used.

The use of a separate motor-generator and flywheel set for supplying the power needed by the mill motor will obviate this objection. In this case a motor large enough to stand the peak loads on the mill will have to be used. The motor-generator set can run at a considerably higher speed, and by regulating the field current of the generator the voltage of this machine may be varied, causing the speed of the mill motor to increase rapidly or decrease correspondingly.

This arrangement is generally known as the Ilgner system. With it, owing to the high speed of the motor-generator and flywheel set, a comparatively small flywheel may be used, and, although the loss of power taking place in the electrical machines is increased, the speed of the mill can be varied at any moment by any desired amount. The increased output of the mill will more than compensate for the increase in losses and the considerable increase of capital cost of the electric plant. An additional advantage with the Ilgner system is that any mill can be used as a reversing mill.

Particulars* of several successful electrifications of steam-driven, non-reversing rolling mills, together with data on power consumption for rolling different classes of materials, follow:

Cold Rolling-Brass Merchant Mill.—This mill consists of one set of breaking-down rolls, one set of second breaking-down rolls and two sets of finishing rolls. The breaking-down rolls are 20 in. (50 cm.) in diameter, 30 in. (76 cm.) long, and all are driven at 6 r.p.m. by a long train of gear wheels. Originally this mill was driven by a single-cylinder horizontal non-condensing engine 28 in. (71 cm.) in diameter, 48 in. (122-cm.) stroke, and run with a boiler pressure between 60 lb. and 80 lb. per square inch (4.2 kg. and 5.6 kg. per sq. cm.). The usual size of ingots dealt with in this mill is 3 in. by 1½ in. by 7 ft. (7.6 cm. by 3.8 cm. by 2.1 m.) rolled down to various gages.

TABLE III—STATISTICS OF MOTOR-DRIVEN MILLS†

	Hamilton, Ont.	Bethlehem, Pa.	Massillon, Ohio
Size of ingot, in	15 x 17	19 x 23	18 x 20
Weight (lb.)	4,000	10,000	5,000
Size of finished material (in.)	4 x 4	4 x 4	4 x 4
Elongation	16	10–12	Up to 20
Number of passes	19	17–21	19–21
Capacity (tons per hour)	60	100	60
Roll diameter (in.)	30	30	30
Pinion diameter (in.)	34	35	34
Speed, full motor field (r.p.m.)	70	40	50
Speed, weakened motor field (r.p.m.)	100	120	120
How driven from motor	Direct	Direct	Direct
Number of motors	2	2	1
Voltage across each armature	600	600	700
Maximum operating torque (ft.-lb.)	900,000	1,550,000	750,000
Maximum motor horsepower	10,000	12,000	8,000
Number of generators	2	2	1
Rated hp. of driving motor of set	1,800	2,000 kw.	1,500
Weight of flywheel (lb.)	100,000	100,000	60,000
Speed of flywheel motor-generator set (r.p.m.)	500	375	375

†From paper presented before June, 1916, meeting of A. I. E. E. by W. Sykes and D. Hall.

The motor used now is a 200-hp., 240-r.p.m., three-phase slip-ring motor, direct-geared by means of cast-iron gear to the mill. The gear ratio is about 4.8 to 1. No flywheel is provided. This equipment has proved extremely satisfactory, and a considerable reduction in the cost of operation and increase in the output has been obtained.

Iron and Steel Merchant Mill.—The mill consists of five pairs of 12-in. (30.6-cm.) rolls running at a minimum speed of 80 r.p.m. and is driven through double helical steel gears (ratio 1 to 2.5) by a 200-hp. direct-current motor at from 200 to 450 r.p.m. Since the mill was electrified an increase of output of over 30 per cent and decrease in the power consumed of 60 per cent have been obtained.

*Obtained from a paper by W. F. Mylan read before the British Institution of Electrical Engineers and from another paper by Koettgen and Ablett before the Iron and Steel Institute.

SIDE GUIDE & GRIPPER

Power Consumption for Rolling Different Classes of Materials.—Re-rolling 90-lb. (45 kg. per m.) rails to a section 16 lb. (8 kg. per m.) per yard, each piece 30 ft. (9.1 m.) long, required 56 units of energy per ton. Total output of mill, 4800 pieces per twelve hours. Small mining rails were rolled from billets 5 in. by 5¾ in. (12.7 cm. to 14.7 cm.), weighing a maximum of 900 lb. (408.2 kg.). In the case of 28 lb. per yard (14 kg. per m.) this comes to an average of 650 lb. (294.8 kg.); in the case of 18 lb. (9 kg. per m.) rails the requirement is as follows per ton rolled: 28 lb. (14 kg. per m.), 38 units; 24 lb. (12 kg. per m.), 42 units; 20 lb. (10 kg. per m.), 45 units; 18 lb. (9 kg. per m.), 48 units. Smaller rails of 12-lb. and 8-lb. (6 kg. and 4 kg. per m.) section required from 49 to 54 units per ton rolled.

Girders 11 in. by 6 in. (27.9 cm. by 15.2 cm.) can be rolled for about 50 units per ton. Channels averaging 1½ in. by ¾ in. by 2 in. (3.8 cm. by 1.9 cm. by 5.09 cm.) require 66 units. Angles 3½ in. by 3½ in. by ⅝ in. (9.5 cm. by 9.5 cm. by 1.6 cm.) from 800-lb. (362.9-kg.) billets require 50 units. Sheet (iron) 8 ft. 3 in. by 33 in. by 0.064 in. (2.5 m. by 8.4 cm. by 0.16 cm.) require 95 units per ton; sheet (iron) 8 ft. by 48 in. by 0.08 in. (2.4 m. by 1.2 m. by 0.21 cm.), 70 units per ton; sheet (iron) 10 ft. by 48 in. by 0.067 in. (32.8 m. by 1.2 m. by 0.17 cm.), 80 units per ton; sheet (iron) 10 ft. by 48 in. by 0.125 in. (32.8 m. by 1.2 m. by 0.32 cm.), 60 units per ton; sheet (iron) 9.5 ft. by 42 in. by 0.09 in. (2.84 m. by 1.07 m. by 0.24 cm.), 84 units per ton, from billets of 7.9-in by 7.9-in. (20-cm. by 20-cm.) section, weigh 388 lb. (175.9 kg.).

In two articles published in the ELECTRICAL WORLD on Sept. 30 and Dec. 16, 1916, the writer suggested a simplified method for calculating the proper size of motor and flywheel to be used when the demand of power on the rolls at any moment is known. The graphical solutions given should be found very handy in avoiding long calculations.

Tests of Iron-Wire Transmission Line

Comparison of Losses in Similar Iron-Wire and Copper-Wire Lines, Made by the Engineers of a Middle West Company, Shows That Construction of the Former Type Is Not Advisable on Certain Classes of Lines

ON ACCOUNT of the increased cost of copper and aluminum the engineers of the Iowa Railway & Light Company of Cedar Rapids, Iowa, installed iron wire as an experiment on a three-phase, 13,200-volt circuit extending west from Marshalltown, Iowa, about 28 miles (45 km.). To offset the poor regulation of the iron-wire induction feeder, regulators (10 per cent buck or boost) were installed at different substations along the line. Later it was decided to ascertain the actual conditions existing on this circuit.

The general characteristics of the transmission line are shown by the data in Fig. 1, the portion tested being that section from Marshalltown to Zearing. Dur-

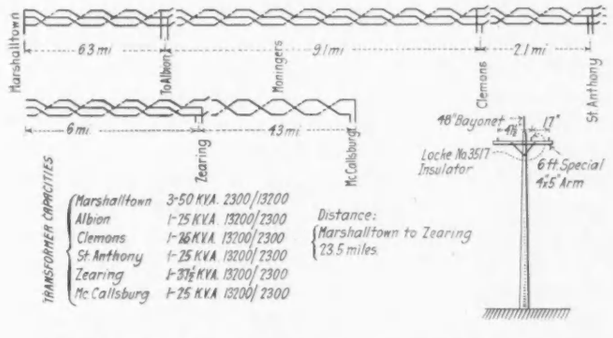


FIG. 1—PHYSICAL CHARACTERISTICS OF LINE TESTED

ing the test the substations other than Zearing were disconnected, and likewise the tap to Albion and McCallsburg. The material and specifications of the line are as follows: The wire from the Marshalltown plant to the substation at Clemons is No. 4 B.W.G. wire (E.B.B.) and from Clemons to Zearing No. 6 B.W.G. wire (E.B.B.), all being solid and spliced with tinned steel splicing sleeves. The pole spacing of the line was 125 ft. (38.5 m.) or forty-two poles per mile (twenty-six poles per km.). Every three miles a complete transposition was made in the conductor positions.

Before testing the line an oscillograph record was taken of the no-load voltage wave of the turbo-generator energizing the line at Marshalltown, and this was found to be within the A. I. E. E. specification for the line wave of an alternating-current machine. The direct-current resistance of one wire loop was next measured with a Wheatstone bridge (in ohms):

Phase	Test I	Test II	Average
A-B	341.2	341.0	341.1
A-C	341.0	343.0	342.0
B-C	344.4	343.0	343.7
Average for test			342.3

From this table the resistance of one wire from Marshalltown to Zearing (124,000 ft. or 37,800 m.) would be approximately 171.65 ohms. The temperature was 80 deg. Fahr. (32.2 deg. C.) in the shade.

The waves on the high side and the low side of the transformers were next photographed, but owing to an incorrect adjustment of the oscillograph the desired results were not obtained. After short-circuiting the three-line conductors at Zearing an impedance test was run by varying the voltage on the 2300-volt side of the step-up transformers at Marshalltown. From measurements of the power input into the iron-wire circuit with varying current and impressed voltage it was possible to obtain the curves shown in Fig. 2.

A load test was made by using two of the three conductors and employing water-barrel rheostats on the low side of the single-phase substation at Zearing. The curves derived from this test are presented in Fig. 3.

After completion of the test at Marshalltown a test

was run on a line equipped with No. 6 copper conductors, but otherwise the same as the iron line. The results of the test corresponded so closely with calculated values that they are not at all included here. The results of the impedance test are given, however, by the curves in Fig. 4.

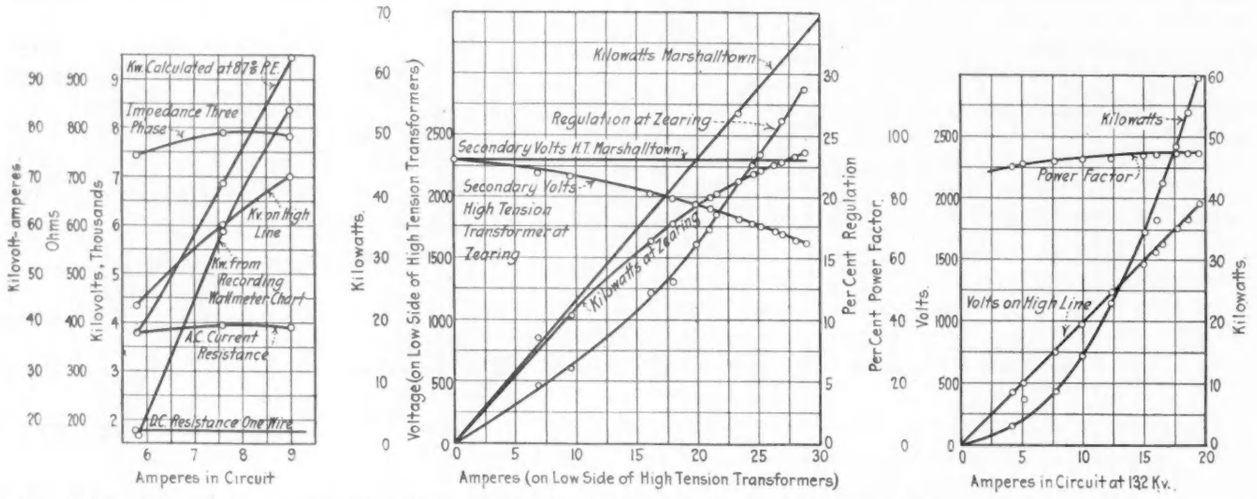
What the Test Data Show

Basing calculations for direct-current resistance on 82,000 ft. (24,994 m.) of No. 4 E.B.B. iron and 42,100 ft. (12,802 m.) of No. 6, it was found that one-wire direct-current resistance should be 165 ohms, whereas the test showed 171.65 ohms. This indicates comparatively low resistance in the splices, etc., when corrected for a temperature of 40 deg. C., as the calculations were based on a temperature of 25 deg. C.

Investigation of the iron-wire circuits showed that there is a point of maximum impedance when considered with respect to the current carried by the circuit. The point of maximum impedance is 8.2 amp., and as the full-load current of the line (based on 150 kva. at 13.2 kv.) is 6.58 amp., it can be seen that the line will be operated near the worst point of current density.

It is interesting to note from Fig. 2 that to furnish the losses in the line at full-load current 5.1 kv. must be impressed between wires at Marshalltown, resulting in a load of 35 kw. This large loss is brought out more strongly in the load test. It should also be noted from Fig. 4 that full-load current was obtained with only 600 volts impressed on the copper circuit and an input of only 5 kw.

The load test results shown in Fig. 3 are based on current. This test was conducted single-phase but gives the existing conditions which have to be met. The large losses and poor regulation are clearly shown by the curves in Fig. 5. At a load of 37.5 kva. (transformer capacity at Zearing) the voltage on the 2300-volt side of the high-tension transformer will be 1875 volts, or the regulation will be 18.75 per cent. This indicates what quality of service will be maintained even with the 10 per cent "buck or boost" regulator. The figures seem to indicate therefore that iron wire is not advisable on long lines of low voltage and comparatively high current densities.



FIGS. 2, 3 AND 4—RESULTS OF THREE-PHASE IMPEDANCE TEST ON IRON WIRE SINGLE; SINGLE-PHASE LOAD TEST, AND THREE-PHASE IMPEDANCE TEST OF COPPER-WIRE CIRCUIT AT IOWA FALLS

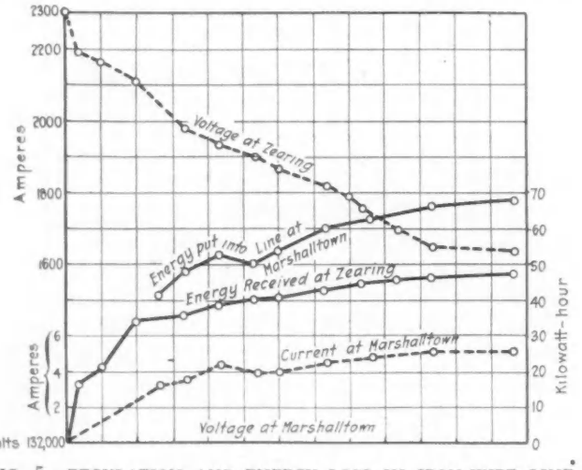


FIG. 5—REGULATION AND ENERGY LOSS IN IRON-WIRE LINE

Uranium Calcium Arc Lamp

The highest candlepower in commercial arc lights has hitherto been obtained by the use of calcium fluoride as the main constituent, which produces a yellow flame. In certain cases, however, a pure white light is a desideratum, this being particularly true of photographic and photo-engraving work. For general street lighting also a white light is to be preferred. In order to obtain an intense light of snowy whiteness William R. Mott of Lakewood, Ohio, in patent No. 1,235,996, suggests the use of uranium as an ingredient together with calcium fluoride.

Uranium in the electric arc probably gives more lines in the spectrum than any other known element, and the arc is exceptionally rich in the blue and violet rays, while it also contains a considerable number of ultra-violet rays. Uranium has the unique distinction of giving 50 per cent more photographic power when used in the arc than rare-earth fluorides or titanium oxide. Moreover, when mixed with calcium fluoride in making up an arc lamp electrode it fully blends with the yellow rays of the latter to produce an intense snow-white light of extraordinary photographic power.

SIDE GUIDE & GRIPPER

Analysis of 1000-Kw. Plant's Revenue and Expense

Detailed Figures Covering All Items Show Marked Effect Exercised by the Prevailing High Prices Even Under Conditions That Are Especially Favorable to Economical Operation

WIDESPREAD talk about increasing coal prices, announcements of rate increases by many companies and actual power shortages in some communities have forcefully conveyed the general impression that unusual things are happening inside the central station industry. The data here presented show, on analysis, in detail the reason why these unusual conditions prevail. These figures were obtained from the records of the Crawfordsville (Ind.) Electric Light & Power Company. This concern, serving a population of 13,700 in Crawfordsville, Linden, Wingate, Waynetown and New Richmond from its 1000-kw. station, has not experienced in a degree so marked as have many of its neighbor companies the difficulties that arise out of having to buy necessities at high prices. Its case is not by any means the worst that might be chosen in Indiana as an example of the effect of high prices on operation. It is perhaps nearly typical, as is indicated by the fact that the operating ratios over the last four fiscal years, ended in July, were: 1914, 49 per cent; 1915, 52 per cent; 1916, 55 per cent, and 1917, 63 per cent. It should also be observed in connection with these data that this increase in operating ratio took place at the same time the company was making a 14 per cent net gain in customers and was increasing its peak load from about 500 kw. to 1100 kw. on a 1000-kw. plant.

WHAT THE LOCAL CONDITIONS ARE

Before going into a detailed analysis of the increasing costs, however, it may be well to state a few general facts concerning the Crawfordsville concern. It operates a modern mechanically stoked steam-turbine jet-condensing station containing two 500-kw. machines. Its lighting rates range on a sliding scale from 7 cents down to 4 cents per kilowatt-hour. Its power rates range from 4 cents down to 1 cent. Ten per cent is allowed for prompt payment. The minimum monthly bill for light is 50 cents, and that for power is 50 cents per horsepower up to 10 hp. and 25 cents for each horsepower additional. A lighting contract with the city brings $48 a year for 4.4-amp. arc lamps, $21 a year for 100-cp. alley lamps, and $30 a year for five-lamp ornamental standards equipped with four 60-watt lamps and one 100-watt lamp. Energy for lighting the small neighboring towns is sold for 3 cents per kilowatt-hour at the station switchboard and is sent out over lines owned by other concerns. Electrical merchandise sales are not pushed, and the company is gradually withdrawing from this business in favor of local contractor-dealers. The present plant peak is actually larger than the station rating, and about 900 hp. in power load is waiting to be taken on.

Turning to the revenue account for the last four years, in Table I, it will be observed that the income is divided into five general classes, namely, commercial lighting, municipal lighting, commercial power, sales to other utilities, and miscellaneous earnings. These data are shown just as they are taken from the company's books, "cents" being omitted. The revenue from flat-rate commercial lighting is a heritage which is now gradually being worked over to a metered basis. In it there are some sign lighting and some employees' accounts. Fixed charges on power customers were eliminated in 1917 in favor of a minimum charge. The earnings for electricity sold in Crawfordsville show a return of $7.45 per capita. The earnings from the four smaller towns to which energy is sold at wholesale and for which the Crawfordsville company is obliged to supply no transmission lines or distribution systems amount to $1.85 per capita. In the records of metered commercial lighting revenues the effect of a rate reduction is clearly shown. The top step in the rate was lowered from 10 cents to 7 cents in 1914, and, as the figures show, it took three entire years to get the gross lighting revenue back to where it was on the 10-cent rate.

TABLE I—REVENUES OF THE CRAWFORDSVILLE ELECTRIC LIGHT & POWER COMPANY

	1917	1916	1915	1914
Commercial lighting earnings:				
Flat rate	$1,339	$1,460	$968	$451
Metered	44,733	40,584	35,957	44,915
Municipal contract lighting	13,672	13,296	13,678	14,737
Commercial power earnings:				
Fixed charges	....	535	3,227	1,061
Metered	24,519	22,404	14,974	8,243
Sale of energy to other utilities	4,438	4,150	3,506	154
Merchandising profits:				
Material	483	2,163	1,620	2,972
Labor	....	—2	45	9
Rent from land, buildings, etc.	—108*	98	101	719
Interest on deposits	1,845	865	293	72
Miscellaneous non-operating	....	....	4	25
Wiring and installation:				
Material	....	1	31	....
Labor	....	399	—7	67
Gross revenue	$90,921	$85,953	$74,404	$73,425

*Houses moved.

Table III, which contains data on operation of the plant from 1914 to 1917 inclusive, shows that while the amount of coal burned had been doubled, the output of the plant increased nearly threefold. Apparently the losses in the plant's auxiliaries have increased from year to year, but the use of this increasing amount of energy in the station is attributable to the increasing load, which has made it necessary to run both machines sixteen hours a day, whereas formerly one machine carried all but the peak. This plan of operation, of course, increased the use of energy by auxiliaries. The losses in the distribution system, however, have decreased from 18 per cent in 1914 to 15.3 per cent in 1915 and 1916 and to 17 per cent in 1917. This reduction was made by relocating some transformers and by taking down some of the smaller units. The increase in 1917 over 1916 is believed to be caused by increasing power loads which overloaded some transformers and which dictated the installation of oversized transformers in some cases to take care of future growth. It is also noticeable that the coal per kilowatt-hour was higher in 1917 than in 1916. This is due to the fact that in 1916 it was possible to get

SIDE GUIDE & GRIPPER

No. 5 Indiana screenings, while in 1917 the plant was glad to take No. 6 and No. 7 coal, which are of a lower grade. Furthermore, the operators dared not risk operating on only two boilers in 1917 on account of load conditions, and consequently it was not possible to keep all boilers so clean as they were in 1916. These

TABLE II—EXPENSES OF THE CRAWFORDSVILLE ELECTRIC LIGHT & POWER COMPANY

	1917	1916	1915	1914
Steam power generation:				
Labor	$6.375	$5,950	$5,414	$5,928
Material	1,304	1,018	1,089	747
Fuel	16,614	11,270	9,848	8,953
Maintenance:				
Labor	492	364	422	294
Material	4,465	1,531	759	994
Transmission and transformation:				
Labor	....	....	7	37
Material	....	....	....	205
Maintenance:				
Labor	187	558	127	311
Material	111	500	3	113
Distribution:				
Labor	382	185	365	161
Material	293	337	296	2,679
Maintenance:				
Labor	1,176	1,028	563	493
Material	381	226	930	2,219
Consumption:				
Labor	520	451	534	564
Material	12	50	607	280
Maintenance:				
Labor	283	694	296	486
Material	1,677	540	273	133
Commercial:				
Advertising	....	....	381	588
Supplies	69	246	14	19
Salaries	319	332	284	322
General expenses:				
Salaries	4,735	4,325	4,773	6,515
Rent	360	360	360	360
Supplies and expense	728	586	489	1,143
Undistributed:				
Injuries and damages	65	19	42	252
Insurance	89	45	26	141
Stationery and printing	313	252	476	140
Stores department	177	397	784	835
Utility equipment:				
Automobiles	899	462	530	463
Wagon	396	416	16	312
Depreciation	12,000	12,000	1,091	....
Interest	3,036	3,036	4,307	....
W. O. No. 1-A, labor	....	....	1,559	....
W. O. No. 1-B, material	....	....	2,336	....
Building, grounds and fixtures	....	74	....	....
Total expense	$57,458	$47,252	$37,442	$35,687
Gross revenue	$90,928	$85,958	$74,401	$73,431
Total expense	57,471	47,272	39,068	35,698
Net revenue	33,456	38,686	35,392	37,732
Operating per cent	63	55	52	49
Construction and equipment	5,454	8,677	12,150	18,377
Cash on hand	51,480	33,650	17,290	10,753
Depreciation reserve	33,090	6,122	8,966	....
Sinking fund	8,253	20,228	4,254	....

conditions increased the unit coal consumption about 9 per cent. The costs per kilowatt-hour generated and per kilowatt-hour sold were obtained by taking the total cost of generation from Table III and dividing it by the kilowatt-hour records. The revenue per kilowatt-hour sold is based on the energy accounted for. The records of total customers show a saturation of about one meter to five inhabitants.

Table II, which shows in detail the expenses of the company, brings out some interesting facts regarding increases in material and labor costs during the last four years. The expenditure for material during the four years was: 1914, $7,202; 1915, $3,957; 1916, $4,202; 1917, $8,243. Of course, the entire increase of over $4,000 in 1917 was not due to higher prices. The item of $4,465 under "generation" includes three Detrich arches installed to replace old arches which had seen five years' service. The item $1,177 under "consumption" includes some new alley-lamp fixtures, new arc-lamp chain and painting lamp posts. Nevertheless, there was a substantial increase due to higher prices, as may be observed from the fact that the material for operating the plant itself increased from $1,018 to $1,304, or about 30 per cent. The 1914 figures can hardly be used as a basis of comparison, because in that year a great deal of construction was still in progress, as may be seen by the construction and equipment account, amounting to $18,377.

The company has spent for labor in the last four years the following amounts: 1914, $8,236; 1915, $7,728; 1916, $9,230; 1917, $9,415—showing that the labor cost has increased steadily since the retrenchment in 1915, and this in spite of the fact that the company has consistently employed less labor. This increase would surely have been more marked had not the plant been equipped with efficient coal-handling facilities which enable coal and ash to be handled for 0.08 cent a ton.

In its fuel costs, which with other plants have been very burdensome, the company has been particularly fortunate. Its coal consumption has about doubled since 1914, and its coal cost has also about doubled. That so favorable a condition prevails is attributable to the fact that the company did not have to buy coal in the open market. For the coming year there will no doubt be an increase because the contract price has increased.

The data at the bottom of Table II accurately summarize the foregoing details. They show that gross revenue has increased from $73,431 in 1914 to $90,928 in 1917. Expense in the same period increased from $35,698 to $57,471, and the operating ratio increased from 49 per cent to 63 per cent. The year 1916 was the best in the period, as is shown by the net revenue account. In that year the company reaped a reward which it earned by close attention to every detail that would make for economical operation, which even high prices would not then offset. It should be noted in connection with this summary that taxes have not been taken into account. The reason is that the plant does not pay taxes. For purposes of complete comparison, however, the following data are given as the taxes which would have been levied had the property been taxable: 1914, $3,570; 1915, $3,704; 1916, $4,069; 1917, $4,179—an increase in hypothetical taxation of about 14 per cent for the period.

Taken as a whole, these figures show quite conclusively that even under very favorable circumstances

TABLE III—OPERATION OF THE CRAWFORDSVILLE ELECTRIC LIGHT & POWER COMPANY

	1917	1916	1915	1914
Tons of coal on hand	421	241	15	500
Tons of coal received	11,022	9,138	7,413	4,820
Tons of coal burned	10,699	8,957	7,098	4,305
Tons of coal sold	.....	.....	90	.....
Tons of coal left	744	422	240	15
Kilowatt-hours generated	3,417,700	3,114,400	2,081,178	1,719,314
Kilowatt-hours used in plant	72,750	71,900	49,400	22,920
Kilowatt-hours output	3,344,950	3,000,500	2,031,778	1,696,394
Kilowatt-hours accounted for	2,769,184	2,643,159	1,804,675	1,396,476
Kilowatt-hours loss	575,766	399,321	276,503	322,838
Per cent loss	17	15.3	15.3	18.
Pounds of coal per kw.-hr.	6.2	5.7	6.7	6.2
Cost per kw.-hr. generated	0.016	0.014	0.019	0.0202
Cost per kw.-hr. sold	0.019	0.016	0.025	0.0259
Revenue per kw.-hr. sold	0.032	0.033	0.035	0.0526
Peak load	1,100	1,050	750	500
Maximum daily output	12,450	11,350	8,600	7,324
Minimum daily output	3,100	3,000	2,135	2,080
Total consumers	2,073	1,945	1,802	1,703

the company has been seriously troubled by increasing costs. The data also constitute another bit of evidence that the requests for increased rates by many Middle Western companies will find justification. During the period covered by this analysis the Crawfordsville company has been operated under the direction of F. H. Miller, manager.

OBSERVATIONS REGARDING BREAKDOWN OF CABLE TAPE

Effect of Temperature of Impregnating Compound, and Relative Advantages of Abutting and Half-Lap Windings

BY L. F. PUTNAM

While in charge of the research and experimental work of one of the large public service corporations, the writer's attention was called to the change in composition of the compound used for filling pot-heads and

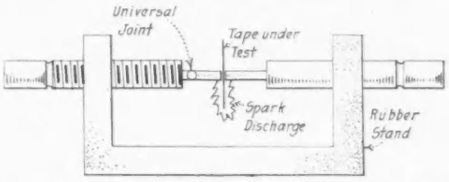


FIG. 1—METHOD OF IMPRESSING POTENTIAL ACROSS TAPE, THE AVERAGE BEING 8600 VOLTS

sleeves of high-tension cables. Inability on the part of manufacturers to import materials had occasioned a change in the formula of the compound which resulted in a higher melting point. It was also noticed that the "chill point" practically coincided with the melting point, so that in cold weather the compound had to be heated to an extremely high temperature in order to be used. The question then arose as to the possible damage done to "Linotape" insulation by pouring in the hot compound.

Consequently samples of tape 1 in. (25.4 mm.) wide were taken and heated in an electric oven, one sample being removed for each 20 deg. rise of temperature. The last samples removed were heated well above the highest temperature used in melting the compound. Other samples were heated in the compound to different temperatures and removed.

These samples were then subjected to a high-voltage breakdown test (Fig. 1), in which it was found that all the samples apparently broke down at the same voltage. More careful examination showed, however, that none of the samples had been ruptured, but that a flash-over had occurred in each case. That is, the tape was so narrow, 1 in. (25.4 mm.), that a high-voltage discharge would pass around it rather than puncture.

As soon as it became certain that the testing apparatus would not rupture the tape it was decided to find some method of wrapping or combining several layers and puncture the sample so made. Six brass rods 0.5 in. (12.7 mm.) in diameter were wrapped, each with a

TABLE I—RESULTS OF BREAKDOWN TESTS WITH BUTT-WRAPPED TAPE

Number of Layers	Maximum Voltage at Breakdown	Voltage Difference Due to One Extra Layer
2	4,600	....
3	9,000	4,400
4	14,000	5,000
5	18,500	4,500
6	23,300	4,800
7	27,800	4,500

different number of layers of tape. In order to insure a smooth specimen, the tape was wrapped spirally, with butting instead of lapped edges, each layer being wrapped in the same direction (Fig. 2). A ring of brass was slipped over the whole specimen, and the terminals of the testing transformer were connected to the rod and ring.

Table I gives the data resulting from this test. The values in the last column being less than the flash-over voltage obtained with the apparatus of Fig. 1, it was evident that no puncture occurred in any case recorded.

TABLE II—RESULTS OF BREAKDOWN TESTS WITH TAPE WOUND IN HALF LAP

Number of Wrappings	Number of Actual Layers	Breakdown Voltage	Extra Voltage Due to One Wrapping or Two Layers
1	2	4,700	....
2	4	9,200	4,500
3	6	14,000	4,800

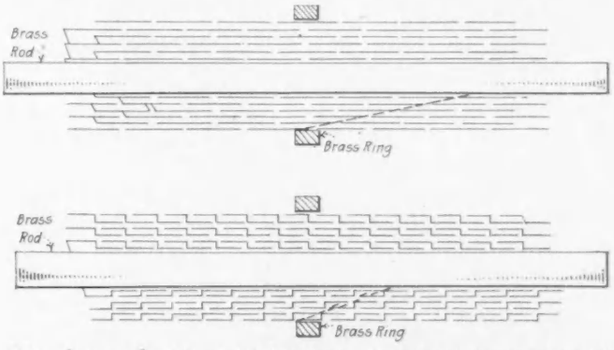
In other words, the breakdown occurred by flashing over between layers as shown by the dotted line in Fig. 2.

It was thought that this flash-over between layers might have been occasioned by the method of wrapping. Other samples were therefore prepared in which the tape was wound in the usual half lap as shown in Fig. 3. Table II gives the data obtained in this series of tests. No punctures were obtained.

It must be remembered that one wrapping of half lap requires twice as much tape as one layer of butt lap, as twice as many turns are made in the same length. It may be seen, however, by comparing Tables I and II that each additional wrapping of half lap gives only the same additional insulation value as one layer of butt lap. That is, to get insulating value with the usual method of winding tape (half lap) twice as much tape is required as is needed with the butt-lap method.

The above is true, of course, only when tape is so strong electrically, or else so narrow, that breakdown occurs by flash-over rather than by puncture. Practically all of the tapes of the "Linotape" class will break down in this manner.

The companies manufacturing cable for high-tension work evidently know the value of the butt lap, as it is nearly always used. After the above tests were completed and the diagrams Figs. 2 and 3 drawn, the reason of the advantage of the butt lap became apparent, the breakdown voltage being proportional to the length of the breakdown path. It is certain, however, that



FIGS. 2 AND 3—TEST ROD WRAPPED SPIRALLY WITH TAPE SO THE EDGES BUTT, AND HALF-LAPPED TAPE WRAPPED ON ROD FOR TEST

most users of the class of tape referred to are unaware of the waste of material occasioned by the use of the half-lap method. It should be noted that to gain the advantage of the butt-lap method of winding each layer must be wound in the direction of the preceding one.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

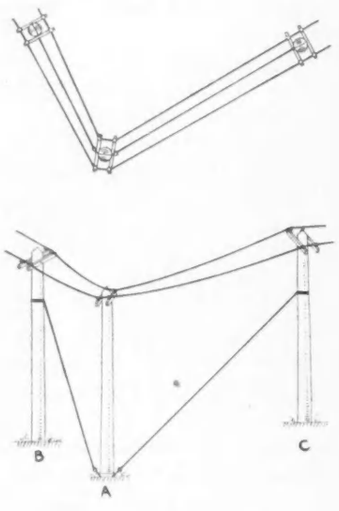
CORNER CONSTRUCTION FOR RURAL-SERVICE LINE

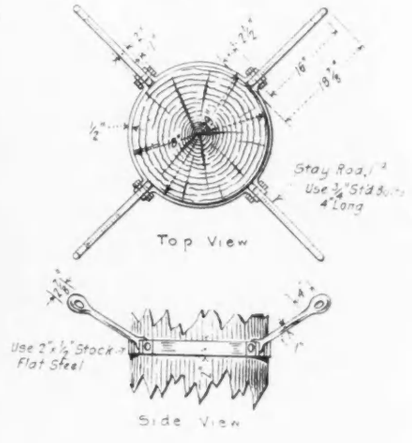
Description of a Method of Guying Poles That Eliminates the Necessity of Using Anchors on 90-Deg. Corners

BY M. H. WAGNER
Engineer Dayton (Ohio) Power & Light Company

An unusual method of guying poles at sharp turns in the line has been adopted by the Dayton (Ohio) Power & Light Company. Three poles are employed at the corner, the pole at the apex of the angle being used as an anchor pole to hold the line in both directions.

The line on which this construction is employed consists of 40-ft. (10.2-m.) class A Idaho cedar poles, fitted with bow-arrow cross-arms giving a 72-in. (1.8-m.) triangular wire spacing. The wires are No. 4 B. & S. hard-drawn, stranded bare copper. The sky wire is carried on an angle-iron bayonet. The guys each consist of two 3/8-in. (9.5-mm.) Siemens-Martin galvanized strand. The line is built on private right-of-way which, as a rule, follows the fence line. Therefore two-pole corners with the short span cutting the corner could not be used because this construction would have necessitated securing a special aerial right. In that case it would also have been difficult to maintain the uniform wire





FIGS. 1, 2 AND 3—ARRANGEMENT OF POLES AND CONDUCTORS IN A THREE-POLE CORNER; CORNER POLE WITH CONCRETE COLLAR HOLDING GUY RODS; DETAILS OF POLE CLAMP

This construction has been used with special success on 90-deg. corners, which, from the guying standpoint, are most difficult to build.

The method of installing such a corner is illustrated in the accompanying drawings. All the poles at the corner are double-armed, and *B* and *C* are head-guyed to the base of pole *A*. In effect this arrangement has the same results as dead-ending the line at *C* and *B*, and allows loose spans to be strung over the 50-ft. (12.6-m.) spaces *CA* and *AB*. The proper spacing between conductors in these spans is maintained by lengthening the arms on pole *A* to allow for the shorter effective distance that would come between pins if standard arms were set at an angle on pole *A*.

Around the ground line of pole *A* is a clamp like that shown in Fig. 3. It is made in four parts and is arranged so that short steel guy rods, made from 1-in. (2.5-cm.) round stock, can be attached to the bolts. After the guys are drawn up taut a 6-in. (15.2-cm.) collar of concrete is molded around the pole so it extends 18 in. (45.6 cm.) below the ground line and 12 in. (30.4 cm.) above it.

spacing which the three-pole corner permits. The three-pole construction has the further advantage that it meets with the approval of the farmers and that the pole under strain is protected by concrete from grass-fire risks, which occur frequently in country districts.

Use of Bonus System in the Boiler Room

BY C. T. BAKER

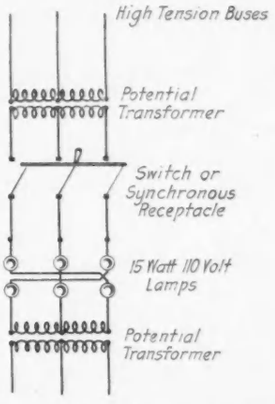
In reference to the article on this subject appearing on page 765 of the Oct. 20 issue of the ELECTRICAL WORLD, the writer believes that while some apparently good reasons were given why the bonus system might not work satisfactorily in the boiler room, there are many plants where the system is entirely satisfactory and where the over-all boiler-room efficiency has been considerably increased since its introduction. There are boiler-room employees who will attempt to take advantage of a given condition, and in some plants they will succeed. However, there are ways of handling such situations which are purely operating details and can be made successful by proper organization.

SIMPLE SYNCHRONIZING SCHEME

Lamps Connected to All Phases to Facilitate Determining Exact Point of Synchronism

BY DAVID R. SHEARER

Illustrated herewith is a synchronizing arrangement which has proved of considerable value in many small plants and even in much larger stations where the switchboard expense must be kept to a minimum. Lamps are placed in all three phases, as it is found to be a great deal easier to determine the exact point of synchronism if bright guide lamps are used in connection with the dark lamps. Speed under and above synchronism is also easily determined by the flashing motion of the six lamps. The advantage of having the phases crossed between the lamps rather than above or below them is that the two lamps on differing phases are placed very close together. Furthermore, it is comparatively easy to determine when the center lamps are dark and the outside lamps are at equal brightness, which is the condition which should exist when synchronizing. Several plants have been using this arrangement for some time, and in many cases the operators prefer it to a synchroscope.



CONNECTIONS THAT MAKE SYNCHRONIZING EASIER

CROSS-ARM EXTENSION BRACKET

Obviates Large Expenditure Where Circuits Must Be Added to Already Filled Cross-Arms

Occasionally it is found necessary to add a wire to a circuit carried on a cross-arm having all line positions already filled. If the existing cross-arm is changed to one having more positions, or a second arm is added, running the additional wire then becomes very expensive.

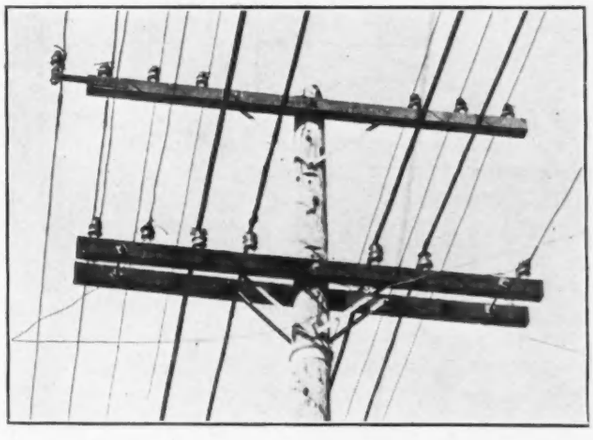


FIG. 1—LINE USING CROSS-ARM EXTENSION BRACKET

A makeshift which will often be found useful in such cases is the cross-arm extension bracket illustrated herewith. It is made of pipe and fittings which can be readily obtained from any hardware dealer, and consequently will be found especially desirable in these days of delayed factory shipments.

The bracket should have two coats of paint, preferably of the same color as the cross-arm, as a protection against corrosion. It will be found that the T can be screwed on tightly enough so that there will be no tendency to untwist. A standard N. E. L. A. 9-in. (22.9-cm.) locust pin will fit snugly into the T.

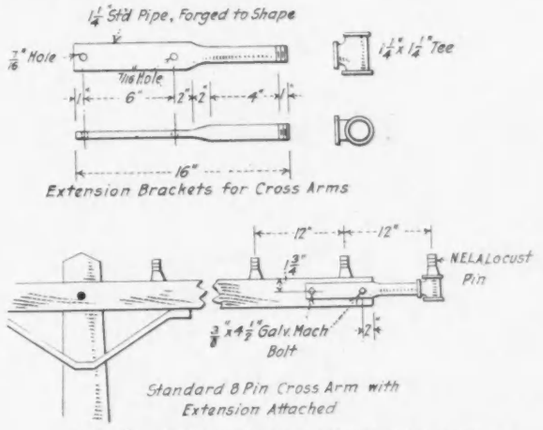


FIG. 2—DETAILS OF EXTENSION BRACKET

ATTACHMENT USED TO REEL WIRE

Reels Clamped to Rear Wheel of Automobile Have Been Found to Provide a Convenient Method

The United States Forest Service standards call for heavy wire for telephone lines, and with the hand reels ordinarily used in rough country work the process of winding up the line is slow and laborious. To speed up the work on lines that are accessible by automobile, a reel is clamped to the rear wheel of the automobile, the axle is raised by jacks, and the line is reeled up as rapidly as may be desired. The accompanying view shows the attachment being used in the Colville National Forest, Washington.

REELING WIRE WITH DRUM ATTACHED TO AUTOMOBILE WHEEL

VENTILATING STORED COAL

Discarded Boiler Tubes Used to Admit Air and Thus Liberate Heat Caused by Oxidation

The Galesburg (Ill.) Railway, Lighting & Power Company, in storing coal on a narrow strip of property between its coal tracks and a fence, places large lumps of coal along the tracks to "wall up" the finer coal,

BOILER TUBES PROTRUDING FROM PILE OF STORED COAL WHICH THEY VENTILATE

which is placed in the center of the pile. To reduce the danger of spontaneous combustion in the pile old boiler tubes are laid in the coal as the pile is made. By this plan it is hoped sufficient ventilation will be provided so that temperatures necessary for spontaneous combustion cannot be developed.

RUBBING OF ROTOR WILL CAUSE FREQUENT TROUBLE

Method by Which This Condition Can Be Detected Before It Is Too Late—Result of Neglect in Actual Case

BY E. C. PARHAM

Ordinarily rubbing of the stator of an induction motor by the rotor is announced by the fuses blowing, the frequency gradually becoming greater as the arc of the rubbing contact increases. In course of time, if the condition is not detected, the extra load imposed by the mechanical friction and the local heating due to the friction will result in damage that can be repaired only at great expense. The most common method of testing for bearing wear of small motors is to lift the working end of the rotor shaft up and down by hand to note if there is any knock. In doing this the stress should be exerted sideways as well as upward, because the greatest amount of wear does not always take place on the bottom of the bearing lining. In any event, if there is any knock at all the rotor should be removed and stator pole surfaces inspected for rubbed areas.

In one case which came to the attention of the writer a 20-hp., 220-volt, three-phase induction motor was giving trouble due apparently to a hot bearing on the pulley end. The whole end of the motor would get too hot to touch, and it became impossible to keep oil in the bearing on that end. The owner hesitated about stopping the motor because its continuous operation was so important. Instead he tried to cool the bearing with a block of ice. Finally the fuses in the pole transformer that supplied the motor gave way.

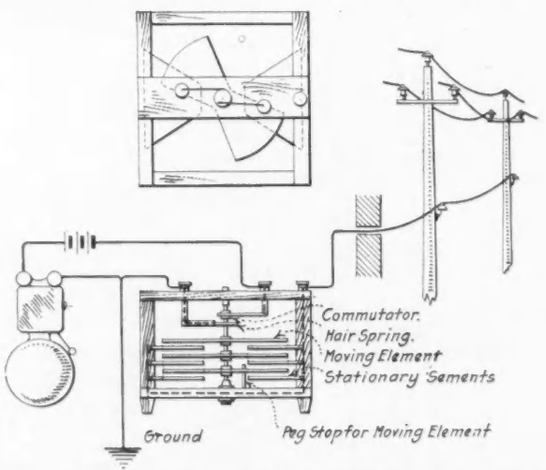
The first abnormal condition noted was that the motor was not protected by means of fuses. Furthermore, the transformer fuses were large enough for ten such motors. Inspection disclosed that rubbing had worn some of the stator laminations almost through to the winding. Judging from the wear of the bearing on the other end of the motor, the excessive heating must have been due, not to a hot bearing but to the rubbing of the stator by the rotor. Fortunately, the stator winding was not injured, and after renewing the bearings on both ends of the motor normal operation was permitted again. The owner of the motor also hastened to order a fuse panel for his second-hand compensator.

DEVICE FOR INDICATING DEAD INCOMING LINES

Trouble-Saving Arrangement Used at Important Junction of Lines in Cases Where Telephones Become Inoperative

So much trouble was experienced with the telephone communication at an important but isolated junction of several long power lines in Tennessee that the apparatus illustrated herewith was devised to ring a bell whenever one or more of the sections are de-energized. This was necessary because the telephone system which had been used paralleled the transmission lines and was seriously affected during line disturbances, lightning, etc., and because the nearest long-distance telephone was 15 miles (24.1 km.) distant.

The apparatus which was developed consists of an electrostatic voltage indicator constructed chiefly of old



ELECTROSTATIC VOLTAGE INDICATOR CONNECTED TO WARN OF INTERRUPTION OF SERVICE

watt-hour-meter parts. One span of wire is strung parallel to the power line and connected to the stationary segments of the voltage indicator. Two years' use of the apparatus has demonstrated its value when the telephone is out of service and one or more of the transmission lines are in trouble.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

RAPID GROWTH CHARACTERIZES DOMESTIC APPLIANCE LOAD

Larger Holiday Trade than Ever Anticipated All Over the Country—Price Concessions Less Necessary than in Former Periods

Almost without exception electric light and power companies engaged in retailing domestic appliances are meeting with an unprecedented demand from their customers. Sales are not only larger, but they involve much less expense than formerly. It has been found that expensive campaigns are not so necessary. Larger results are being obtained from smaller advertising expenditures. The reason, of course, is apparent; the supply of domestic labor is inadequate, and, besides, many customers are now for the first time in a position financially to purchase electrical appliances.

One large company in the East sold more vacuum cleaners recently in a few weeks than it used to sell in six months. A Southern property in the first month of its sale of electric-driven sewing machines disposed of forty-seven motors and fourteen complete sewing machines. Another company in one month sold at regular prices fifty-six washing machines in addition to other laundry appliances.

Many other instances could be cited, all of which would show that domestic labor-saving devices for the home are selling faster than ever before. In this connection, however, it has been noticed that some, not all, companies are still prone to offer exceptional price inducements to customers. In some instances, of course, these prices do represent a profit on the prices that were in effect as late as 1915, and it is not unlikely that in many of these instances the goods now sold were purchased at the lower prices. This is not true, however, in all cases.

DOMESTIC LOAD GOOD FOR ALL TIME

One thing is certain. This domestic load now being taken on is not one to fall off markedly when dull times come along. It is a fairly steady load. Moreover, except for electric cooking, this load is served at the maximum lighting rates, and thus has in most instances a high earning value to the utility.

Furthermore, this load represents not a single penny of outlay for line extension. The present installation is sufficient to accommodate the household devices.

Reports to the ELECTRICAL WORLD from every section of the country are to the effect that electrical labor-saving devices will have a far greater demand this coming Christmas season than ever before. For some years now the industry has been educating the public to give electrical presents. This year the Society for Electrical Development is back of a movement to stimulate holiday buying of electrical goods. The outlook from the demand viewpoint is encouraging.

The question that arises, therefore, at this time is that of supply. Are the retail distributers sufficiently well stocked to supply the demand? It is doubtful if at this time an order of any size can be filled in time to meet the demand. Local jobbers in some instances have fair supplies of some products.

With the more or less limited supply on hand and with buying anywhere near as large as is anticipated, it becomes very evident that special inducements in price will not be as necessary as they may have been in the past. In fact, it will probably be found that customers will come prepared to pay the price asked. The public generally does not know the price of electrical goods, and consequently present prices bring up no unfavorable comparisons, but are accepted as they are. In fact, it has been found right along that the heavy demand has not come in the least expensive lines.

Furthermore, with expenses outdistancing those of the past, the profit on labor-saving devices will go a long way toward meeting the commercial department costs. While a good many companies are to-day putting into practice economies wherever it is felt they will produce results, it is equally justifiable to consider more ways of making a profit. It is a well-recognized fact that expense curtailment can only go just so far, beyond which it defeats its purpose.

UNIT COSTS FOR ACCIDENTS TO STREET-LIGHTING EQUIPMENT

Plan for Rendering Bills Promptly Proves of Assistance in Collecting Damages from Careless Automobile Drivers

The electrical department of Lincoln Park, Chicago, which operates and maintains about 8 miles (12.87 km.) of ornamental street lighting, has worked out a plan which enables it always to submit a bill for damage done to posts on its system within twenty-four hours after the accident occurs. This plan has enabled the commissioners to reduce considerably the number of uncollectible accounts arising out of accidents in which automobile drivers collide with lighting standards on the curbs and on the "isles of safety" that mark important street intersections.

The importance of such a system is apparent from the fact that last year it was necessary to write off about $4,500 for damages of this sort on which the park could not collect. The insurance limit expiring in thirty days was responsible for a large part of this. It is also interesting to note that on the 8 miles of street lighted in the park as many as forty accidents to posts sometimes occur in the course of a single month.

The scheme was worked out as follows: From a large number of accident repair jobs in which automobiles had caused the damage averages of repair costs were

worked out. This gave the department a fair set of unit prices on which to base estimates of the cost of repairing any sort of damage to posts on its system. These unit costs are filed in the department's office, so that as soon as a complete report of the extent of damage from any accident is received an estimated bill for repairs can be mailed to the owner of the offending car. Collection is made on the basis of this estimated bill. As prices change the prices must, of course, be revised. The accompanying table shows the unit prices as approved and placed in effect in September, 1917, by Claude H. Shepherd, electrical engineer for the Lincoln Park Commissioners.

PRICES OF STREET-LIGHTING EQUIPMENT, LINCOLN PARK

UNIT COST ISLE MATERIAL

Isle post	$16.60
Red globe	7.15
No. 14 duplex wire	0.03
Rubber connectors	0.35
Eight-light clusters	3.00
Isle-light sign	3.60
Rubber tape	0.44
Handhole cover	0.60
Friction tape	0.17
16-cp. lamp	0.20
32-cp. lamp	0.22
Isle base	18.35

UNIT COST LAMP-POST MATERIAL

20-in. Alba globe	$8.53
18-in. Alba globe	2.75
W. E. 400-cp. lamp	3.00
Protector for globe	0.88
Cement, per bag	0.65
Concrete post	22.60
Compensator	4.04
Triple-braided cable	0.075
Isle transformer	8.80
No. 1 duplex L. & R. cable	0.185
Cap and grill	15.00
Mogul socket and plate	1.50
2-in. galvanized pipe, per foot	0.18
2-in. elbow	0.45

	Labor	Sta. Exp.	Transp.	Material
Setting concrete post	$19.75	$8.00	$6.12	$51.20
Rebuilding manhole	27.22	5.52	2.75	27.25
Splicing in transformer	5.50	1.60	0.75	9.50
Lamp and globe broken, concrete post	0.85	1.00	1.00	*
Island light damaged without base	8.26	6.48	1.75	*
Island light base replaced	16.60	5.50	3.75	21.60
Island globe and lamps damaged	0.90	1.75	0.75	*

*See list for material.

STRICT MEASURES FOR REDUCING DELINQUENCIES

Municipal Property When Account Runs for More than Two Months Denies Service Until Settlement of Bill Is Made

A municipal electric lighting system in one of the small Eastern towns has recently decided on a very strict measure for reducing delinquent accounts, and the plan is meeting with success. Instead of allowing customers to accumulate large unpaid accounts, the lighting plant's officials have decided that as soon as an account becomes two months old the customer will be considered a delinquent and further service denied until it is paid in full. It is not expected that this measure will result in the loss of more than half a dozen customers, and already it has proved of benefit in reducing delinquent accounts.

Because of commission regulation it would, of course, not be possible for some companies to adopt such a measure. It is, nevertheless, true that a good many properties, especially smaller ones, could make much more stringent rules for delinquent accounts than they now have. At the present time not only must economies be effected in every possible way, but also it is equally important that all money owing the company shall be paid as promptly as possible. Electricity has reached such a position in civilized life and in present-day homes that it will probably not be found that strict measures will reduce the number of customers to any appreciable degree. On the contrary, they may materially increase the company's earnings by reducing the loss from unpaid accounts both in principal and interest.

MEETING THE COST OF WAR-TIME EXTENSION

Cleveland Electric Illuminating Company Introduces New Form of Contract Whereby Customer Finances Cost of Extensions

The Cleveland Electric Illuminating Company has established as part of its regular rate schedules a form of contract where new construction is required before service can be furnished. Under this contract, printed in full on the opposite page, a customer advances the cost of construction; the normal cost of such construction—that is to say, the cost as of July 1, 1914—is returned to the customer in periodical payments.

SUGAR MILL ELECTRIFICATION RESULTS IN ECONOMIES

Cane-Mill Engineer Points Out that Increased Production as Well as Decreased Costs Accompanied Electric Drive

At the sugar mill engineers' convention held last month at Honolulu, H. I., Robert E. Hughes presented a brief paper recommending the use of electricity in place of steam for drive in all new installations. He was very much in favor of electrification of sugar mills, and while no comparative figures as contrasted with steam drive were presented, he unqualifiedly stated that electricity was the more efficient. Mr. Hughes' remarks on this subject were in part as follows:

With the extension of the use of electricity for motive power in sugar factories, we have sufficient proof that its many advantages are very generally recognized. The application of electricity to all forms of power application has long since passed the experimental stage. The larger the scale on which electric power is generated the greater the economy.

Cane-sugar factory operation and general mill practice have been improved as the result of the application of the electric motor drive to the many pumps and line shafts in the factories, and almost without exception have been attended by the following results: Increased production, decreased operating expenses, decreased maintenance charges, greater ease of operation and increased reliability.

There are now some twenty or more sugar mills in the world completely electrified, and in every one the change to electric drive resulted immediately in better steam economy, lower maintenance and labor cost and greater reliability of service.

THE ILLUMINATING COMPANY

CONSUMER'S CHARGE APPLICATION
FOR COMMERCIAL LOADS IN EXCESS OF 5-KW. CAPACITY

Applies in any instance where the company is required to make an expenditure for the installation or construction of the following:

SWITCHING APPARATUS:
For additional or specific switch gear, meters, instruments, panels, frames, control, cables and buses, connections and transformers, in switch houses or substations.

SUBWAY:
For additional or specific subway from generating plant to substation, from substation to consumer's premises, from generating plant to consumer's premises, or from substation to substation, or from substation to point of feeding overhead line, or from existing distribution system to consumer's premises.

CABLE:
For additional or specific transmission or distribution cable from generating plant to substation, from substation to consumer's premises, from generating plant to consumer's premises, or from substation to substation, or from substation to point of feeding overhead line, or from existing distribution system to consumer's premises.

OVERHEAD LINES—LINE EXTENSIONS:
For additional or specific overhead lines, including poles or towers, with necessary and usual equipment, wire, lightning arresters, line switches, ground wires or connections, or for any work on existing poles or towers, with all the attendant equipment as aforesaid, for increasing the existing distribution system or transmitting direct to consumer's premises.

TRANSFORMERS:
For any step-up or step-down transformers located in switch houses, substations, line houses or other structures, not otherwise specified.

SERVICE ON CONSUMER'S PREMISES:
For the installation of poles, towers, lines, ducts, cables and vaults; also, where the transformer capacity to be installed exceeds 50 kw., for the transformers and switches required; and for special transformers of 50 kw. capacity or less.

Name..... Date.....191.....

Premises.....

The undersigned hereby makes application to The Cleveland Electric Illuminating Company to install or construct, at the expense of the applicant, the following described work:

The above work is to supply.....kw. line capacity to the above premises, which capacity the company agrees to hold and reserve to the use of the applicant for ten years from the commencement of supply, subject to federal, state, county, township or municipal regulation.

1. The applicant deposits herewith the sum of.....dollars ($.....), which is the estimated cost of the above work, upon the understanding that the work constructed shall at all times be and remain the property of the Illuminating Company.

2. Refund to the amount of.....dollars ($.....), which is the estimated cost of the above described work as of July 1, 1914, and hereinafter called the normal cost, will be made to the applicant, subject to the terms and conditions hereinafter specified:

(a) on the current taken and used by the applicant from the work constructed under this application; and

(b) in addition, on the current taken and used by other consumers connected to the line or lines constructed under this application, except where the work constructed consists of feeders or an addition to the network in the general distribution system of the company, in which event refund to the applicant will be made only on the current used by those consumers who are connected to that part of the work specifically constructed for the applicant which extends beyond the network in the general distribution system of the company; provided, however, that in no case shall the amount refunded to the applicant on the current used by any such consumer exceed the normal cost of that portion of the work constructed which is useful in serving such consumer.

3. The amount to be refunded to the applicant shall be based upon the current taken and used within ten years after commencement of supply, but the total amount of the refund shall not exceed the normal cost of the work herein applied for.

4. The refund will be computed at a rate per unit as determined by the following formula:

$$\text{Refund rate per kilowatt hour} = \frac{\text{dollars}}{36000 \times \text{contracted kilowatt demand}}$$

The sum of money in the above formula is the normal cost of the above-described work. The refund will be paid by the company to the applicant annually, subject to the conditions herein stated.

The kilowatt demand in the above formula is the capacity contracted for herein and reserved to the use of the applicant by the company.

5. No refund or interest shall be paid unless the applicant's bills for current have been paid in full; nor shall any annual refund payment exceed fifty per cent (50%) of the sum of the bills for the current taken and used within the refund period from the work constructed under this application as herein provided.

6. The company reserves the right to refund at any time all or any part of the unrefunded portion of the normal cost of the specified work.

7. No refund nor interest whatsoever will be allowed on the excess cost of the specified work, which excess is the difference between the normal cost and the amount deposited.

8. Interest, not exceeding six per cent (6%) per annum, will be paid by the company to the applicant annually, upon the balance of the normal cost held at that time and subject to be refunded as herein provided. The annual rate of interest will be computed by the formula:

$$\text{Rate} = 6/10 \text{ of } 1\% \times \text{average hours use per day of the contracted kilowatt demand.}$$

The hours' use per day of the kilowatt demand in the above formula shall be determined by dividing the monthly average of the kilowatt-hours upon which refund is allowed by thirty (30) times the demand contracted for herein.

9. The interest and refund periods will be considered as terminating on the first day of February of each year, and payments shall be made to the applicant, as above provided for, upon the tenth day of the same month.

Canvassed..... Signed.....

Deposit Receipt No..... .....

All quotations made under this application are subject to change without notice.

All work to be performed is subject to delays due to receipt of material, strikes or labor shortage.

NEW FORM OF POWER CONTRACT COVERING EXTENSIONS

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

DETERIORATION IN HEAT VALUE OF STORED COAL

Experiments Made by the Bureau of Mines Show that the Decrease in Calorific Qualities Has Been Overestimated

A REPORT on the loss in heating value in various coals due to storage, prepared by Horace C. Porter and F. K. Ovitz, has been issued by the Bureau of Mines. These carefully compiled data refer to New River (West Va.), Pittsburgh, Pocahontas and Sheridan (Wyo.) sub-bituminous coals. In brief it may be said that the tests show that the amount of deterioration of coal in heating value during storage has commonly been overestimated. Except for sub-bituminous Wyoming coal no loss was observed in outdoor weathering greater than 1.2 per cent in the first year or 2.1 per cent in two years. The Wyoming coal suffered somewhat more loss, 2 to 3 per cent in the first year and as much as 5.5 per cent in three years. Under severe conditions of outdoor exposure the New River coal deteriorates in heating value approximately 1 per cent in the first year, 2 per cent in two years and not more than 3 per cent in five years. The storage under water prevents practically all deterioration during one year, and no more than 0.5 per cent has been found in any test for two years or less. Salt water possesses no advantage over fresh water in preventing deterioration. Intermittent exposure and partial drying of the submerged coal probably cause deterioration in some degree, although very small.

The submerged storage of New River coal is not to be recommended for the sake of preventing deterioration in heat value. Its advantage lies only in insuring against spontaneous combustion. With Pittsburgh gas coal the deterioration in one year with open-air storage was practically negligible, even in the upper 6 in. (15.2 cm.) of the exposed coal. During the second, third, fourth and fifth years the deterioration proceeded very slowly and did not reach an amount greater than 1.1 per cent in five years. The submerged portions may be said to have suffered practically no loss measurable by the degree of accuracy used. During one year's outdoor exposure the Pocahontas coal deteriorated very slightly (less than 0.4 per cent) in heating value, and the deterioration took place almost entirely during the first six months. There was a further deterioration of 0.4 per cent during the second year. Evidently Sheridan coal (a variety of black lignite) loses 3 to 5.5 per cent of its heating value in about three years' storage, the greater part (70 to 80 per cent) of this loss being in the first nine months. During the period of two and three-quarter years the deep bins suffered the greatest loss, probably because their sides offered greater surface access of air than those of the small bins. The latter became covered with a 12-in. (30.5-cm.) layer of fine slack that helped to protect the layers beneath from oxidation. In the deep bins the lumps became badly cracked but retained their form sufficiently to give more ready access of air and thus permit greater oxidation. When storing this grade of coal for more than three months, covering the bins is not so advantageous as the use of air-tight bottoms and sides and the accumulation of a protecting layer of fine slack on the surface. In this manner the deterioration can probably be kept below 3 per cent in one year and will probably not increase to more than 4 per cent in two or three years if the coal remains undisturbed.

Physical deterioration (slacking), the report goes on to assert, is also very largely prevented in the upper portions by the formation of a closely packed layer of slack, at least 12 in. (30.5 cm.) thick. Although no indications of spontaneous heating were noted in the tests, it is dangerous to store Sheridan coal in piles greater than about 10 ft. (3 m.) in depth or width. In large masses of coal radiation of spontaneously developed heat is restricted to a dangerous degree. Submergence under water would probably prove particularly advantageous as a means of safely storing sub-bituminous coal of the Sheridan type.

Generators, Motors and Transformers

Series and Parallel-Connected Windings in Continuous-Current Machines with Auxiliary Poles.—J. VORONOFF.—The author maintains that the choice between series winding and parallel winding in designing continuous-current machines should be made after a detailed study of the respective advantages and disadvantages of each method and for each machine separately. With the aid of the formulas of Professor Arnold he studies the different cases in which one or the other of the two methods will be the more satisfactory from the point of view of commutation. In addition, he directs attention upon the means of improving the commutation by diminishing the permeance of the slot and the air gap, as well as upon the different manner in which the current acts with each kind of winding.—*Revue Gén. de l'Elec.*, Oct. 6, 1917.

Lamps and Lighting

Code of Lighting School Buildings.—This code has been prepared by committees of the Illuminating Engineering Society in order to make available authoritative information for legislative bodies, school boards and others interested in enactments, rules and regulations for better lighting. While the code is intended primarily as an aid in formulating legislation relating to the lighting of school buildings, it is also intended as a guide to school authorities in individual efforts to improve lighting conditions.—*Illuminating Engineering Society.*

Generation, Transmission and Distribution

Water Power in Sweden.—Because of the scarcity of coal in Scandinavia and the increased demand in Sweden for products which heretofore have been imported from Germany, England and to a small degree from the United States, hydroelectric power production showed enormous gains during 1916. Exact figures for the entire country are, of course, not yet available, as no industrial general census has been taken in Sweden recently, but an inkling of the extraordinary spread of hydroelectric installations is given in the report of the Royal Swedish Waterfalls Commission, which gives a clear financial and technical résumé of what has been accomplished in the state-owned and state-controlled waterworks during 1916. In a purely financial way the waterworks proved very profitable for the state treasury, turning into it a net profit of 1,143,499 kroner. The gross income was 1,580,598 kroner, and the operating expenses (including all the salaries, rents and new equipment) 438,904 kroner. The waterworks under the control of this commission comprise four primary stations, ten secondary stations and sixteen tertiary stations, with high-tension lines stretching for a distance of 781.7 km. (485.6 miles). Of this total distance, 267.9 km. (166.5 miles) operate at 70,000 volts, 90 km. (55.9 miles) at 40,000 volts, and 401 km. (249.2 miles) at 20,000 volts. During the year 1916 no less than forty-six industrial plants, municipal establishments and electric lighting and power companies contracted for energy from these stations, and large additions will have to be built in all the power houses to meet the constantly increasing demand for electricity. The energy developed in the power stations amounted to 121,753,370 kw.-hr. Of this amount the 70,000-volt lines carried 75,688,100 kw.-hr., the 40,000-volt lines 5,973,410 kw.-hr. and the 20,000-volt lines 31,576,960 kw.-hr. Losses in the transformers and for use as lighting and heating current in the power stations and along the lines amounted to 21,150,837 kw.-hr.—*Report of the Swedish Royal Waterfalls Commission, No.* 15, May 31, 1917.

War's Influence on Electric Power in France.—The scarcity of coal in France has caused an extraordinary development of electric generating companies, especially in the Alpine and Pyrenees sections. From a total of 1173 establishments, of which only seven developed more than 10,000 hp., the industry jumped during 1915 and 1916 to more than 5,000,000 hp., with several establishments producing more than 40,000 hp. and one even reaching 250,000 hp. One of the dams in the Pyrenees will gather about 500,000,000 cu. m. (about 654,000,000 cu. yd.) of water for use in the production of electricity. High-tension lines are to distribute the current over nearly all of France.—*Teknisk Uteblad,* September, 1917.

Traction

Barcelona Traction, Light & Power Company.—A. HUGUENIN.—A short history and description of the system of the Barcelona Traction, Light & Power Company. The object of the company is to supply electric energy at cheap rates to the whole of the Barcelona district, and its program includes the conversion of the existing steam-power station at Barcelona into a stand-by station and turning to account the water power available in the rivers Noguera, Pallaresa, Segre and Ebro, from the township of Pobla down to the Mediterranean.—London *Engineering,* Sept. 21, 1917.

Fuel and Electrification in Switzerland.—M. EMANUEL KUHNE.—The scarcity of coal in Switzerland has led to the resumption of mining where it had been abandoned because of insufficient return. There are layers of lignite in several of the cantons, and anthracite is to be found in Valais, where a reserve of 15,000,000 tons is estimated to exist. These somewhat meager sources, however, will by no means take the place of the imported coal used before the war, which in the year 1913 amounted to 107,000,000 francs (about $20,200,000) in value. Consequently a great impetus has been given to the electrification of railroads, which is proceeding rapidly. For the present the government has enforced a reduced schedule on its lines, which has interfered with inter-city relations and even with the mails. Users of gas also have had their supply cut down to three-quarters of what it was, all in excess of this being charged for at a quadruple rate.—*Revue Gén. de l'Elec.,* Sept. 29, 1917 (reprinted from *L'Economiste Français*).

Energy Saving on Street Railways.—A. M. BUCK.—The author discusses the influence of some variables on the energy consumption of street cars. If by slight changes in operating methods it is possible to reduce the input to the cars by 25 to 50 per cent, as may in many instances be the case, the results will be even more than the mere saving in cost of energy represented. The generators will be able to drive more cars, the transmission lines and feeders will likewise have greater apparent capacity, pressure regulation will be improved, and minor savings made all along the line. It is also a fact that the smaller amount of energy passing through the motors will cause less loss in them with reduced heating, so that they can either be used on larger cars or replaced by smaller motors on the old equipment. The savings thus work out into an almost endless chain. These statements, the author says, are not merely theories, but facts proved on many roads in different countries. When it is considered that these benefits are applicable to any road and that but few are availing themselves of them, it seems well worth the while of every manager to see what can be done to induce proper manipulation of his car equipment.—*Sibley Journal of Engineering,* October, 1917.

Installations, Systems and Appliances

Electric Drives for Warships.—A short article discussing some of the most important advantages of electric drive for warships. The article brings out in particular four features of electric drive, namely, interchangeability, backing power, efficiency of transmission and cruising economy.—London *Engineer,* Sept. 14, 1917.

Boiler-House Design.—HERBERT E. BIRCH.—In the first part of this article the author points out the lack of care in boiler-house design as shown by many different arrangements of apparatus and structural details. The article then follows with a statement of the essential requirements and a careful discussion of the advantages and disadvantages of several arrangements. Various methods of storing and charging coal are shown. A page illustration gives cross-sections of several poorly laid-out boiler houses. The second installment of this article takes up the problem of getting the

coal into the boiler-house bunker and deals with elevating and conveying machinery. The general advantages and disadvantages of several types of feeders, coal crushers, elevators and horizontal conveyors are pointed out, with numerous practical comments in regard to their installation and operation.—*Industrial Management*, September and October, 1917.

Electrophysics and Magnetism

Penetrating Powers of the X-Radiation from a Coolidge Tube.—E. RUTHERFORD.—This paper contains an account of some experiments made to determine the maximum penetrating power of the X-ray excited by high voltages in a Coolidge tube using lead as the absorbing material. The absorption has been examined over a very much wider range of intensity and of thickness of absorber than in any original experiment of Rutherford, Barnes and Richardson. According to the tests made, there was not much change in the value of the absorption coefficient μ for the end radiations between 79,000 volts and 144,000 volts and no observable change in μ between 105,000 volts and 144,000 volts. In the latter range the radiation is absorbed nearly exponentially with the value of μ equal to 22. Above 144,000 volts the absorption is no longer exponential, but the value of μ decreases progressively with increase of thickness of absorber. This is best shown by the results for 183,000 volts, where the value of μ decreases from 26 to 12 as the thickness of the absorber is increased from 0.7 mm. to 7 mm. The absorption of the end rays by aluminum was found unchanged between 142,000 volts and 175,000 volts after the rays had passed through 2.49 mm. of lead as absorber. Under these conditions the issuing radiation consisted mainly of the characteristic radiation of lead with the value of μ equal to 22, and no observable change in the absorption of aluminum is to be expected under the experimental conditions. A few isolated and approximate measurements were made of the absorption of the rays by aluminum under different conditions. The observations on the absorbing rays in aluminum and lead throw important light on the probable wave lengths of the penetrating gamma rays from radioactive substances. From the results obtained the author concludes that the wave lengths of the main gamma rays are much shorter than was previously supposed. The gamma rays from radium C consist mainly of waves of about one-hundredth the wave length of the soft gamma rays from radium B and are of considerably shorter wave length than any so far observed in an X-ray tube with the highest voltages obtainable. It appears probable, says the author, that the observed groups of beta rays are due to the conversion of energy into electronic form and that consequently the energy of the beta ray groups may be utilized to determine the wave lengths of the penetrating gamma rays. The result as a whole suggests that the groups of beta rays are due to the transformation of the gamma into single and not multiple quanta.—London *Philosophical Mag. and Journal of Science*, September, 1917.

Emission of Electrons by a Metal Bombarded by Positive Ions in a Vacuum.—W. L. CHENEY.—This paper compares the magnitude of the thermionic current in a vacuum corresponding to various potential differences with the thermionic current corresponding to a potential difference of 15 volts. The ratio of the number of electrons leaving the cathode to the number of positive ions striking it has been found with positive ions of different velocities and for different metals, namely, aluminum and platinum. This ratio has been found to depend on the velocity of the positive ions. It appears that the effect is at least partly due to gas in the metal.—*Physical Review*, October, 1917.

Electrochemistry and Batteries

Steel Making in the Electric Furnace.—This article is descriptive of the first Australian installation for the production of high-grade steel castings and ingots of special steel. It is pointed out that the plant described has been in operation for only six months, but in spite of initial difficulties with local materials and the lack of skilled labor, a standard of regular practice has been reached which compares very favorably with longer-established European plants.—*Commonwealth Engineer*, Sept. 1, 1917.

Lead Plates in Storage Batteries.—L. JUMAU.—Second part of a continued article on the actual state of the storage-battery industry. In this installment the author develops some considerations upon the conditions of manufacture and use of lead plates, directing especial attention to the molecular state of the active materials and their solubility in the electrolyte. The author says that these are new questions that have an important bearing upon the technical qualities of the electrodes and which will well repay further study.—*Revue Gén. de l'Elec.*, Oct. 6, 1917.

Miscellaneous

Coking of Illinois Coals.—F. K. OVITZ.—The data in this paper have been presented by the Bureau of Mines in co-operation with the Illinois State Geological Survey and the University of Illinois to promote a more efficient use of coal. Some of the subjects discussed in this report are the following: Character of coking process; present conditions regarding coking of Illinois coals and future prospects; general results of use of mixtures of Illinois and other coals for making coke; effects of various factors on coking; Illinois coals available for coke making; character of coals; historical review of coking of coals, and detailed results of coking tests.—*Bureau of Mines Bulletin No.* 138.

Some Unusual Features in the Microstructure of Wrought Iron.—HENRY S. RAWDON.—Wrought iron is usually described as being of a very simple structure as revealed by the microscope compared with many of the alloys in commercial use. A study of the microstructure of a series of commercial wrought irons carried out at the Bureau of Standards, however, has shown the occurrence of some very peculiar and unusual variations in structure in such material. Many of the ferrite crystals, when properly prepared and etched for microscopic examination, show a decidedly banded structure instead of the homogeneous appearance usually described. This unusual structure is to be attributed to a relatively high phosphorus content in such portions and to a non-uniform distribution of this element. Although most specimens showing these unusual features of structure are of a rather poor grade, they are not characteristic of low-grade iron in general. The probable relation between such microstructural features and "fatigue" failure of such material is suggested.—*Technologic Paper No.* 97, Bureau of Standards.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

USE OF CENTRAL STATION URGED IN MASSACHUSETTS

Fuel Administrator Commends Use of Central Station Service to Save Coal Badly Needed in New England States

A timely suggestion to isolated-plant owners is being sent out by James J. Storrow of Boston, Fuel Administrator for New England, regarding the economies of central station service under present conditions. Each central station in Massachusetts received a letter recently from Philip Wrenn of the department of power economy at the Fuel Administrator's office, State House, Boston, asking for a list of isolated plants in its territory which in the company's opinion might save fuel by adopting central station service. This letter in a typical case read as follows:

I am writing to you at the request of J. J. Storrow, New England Fuel Administrator.

Because of the serious shortage of coal threatening New England this winter, we wish wherever possible to eliminate such waste as may exist through the maintenance of isolated or independent plants whose power could be furnished by the nearest central station with a materially reduced consumption of coal. Will you be good enough to inform us of the situation in the territory surrounding your station? If there are plants whose type of apparatus would permit them to change to your service without abnormal expense to them or to you, please send us the names of the plants and of the men in control.

Are there any concessions in the form of contract or in price of service which you are willing to make for the period of the war?

Central stations receiving these letters have in general recognized the opportunity afforded to press home the economic value of their service. Lists have been forwarded to the Fuel Administrator as requested, and the following typical letter has been sent by Mr. Storrow's office to the power users considered as "prospects" by the central stations:

Because of the very serious shortage of coal throughout New England we have asked the central stations throughout the State to send us lists of isolated plants which in their opinion could with very little or no expense save an appreciable amount of coal by taking power from the central station. The Worcester Electric Light Company (*e.g.*) has named your plant as one coming under this head. May we ask you to give this matter your urgent consideration?

In the case of the Worcester company the names of seventy-one isolated plants with a total prospective additional power load estimated at about 10,000 kw. were sent to Mr. Wrenn. These plants were classified under two lists, one showing the installations either on the company's lines partly or which easily could put their whole load on these lines, or plants that could be changed over at little expense, the other plants requiring a complete change-over from engine to electric motor drive. It was pointed out that the principal difficulty in making this addition to the local system's load would be in securing motors and transformers for the required large increase in service. At Worcester there are forty-one plants of the class requiring complete change-over, with an estimated load of about 5500 hp.

At a recent meeting of the fuel committee of the Boston Chamber of Commerce W. H. Atkins, general superintendent Edison Electric Illuminating Company of Boston, stated that if all the isolated plants now in the Boston territory could be taken over into Edison service there would be a saving estimated at 300,000 tons of coal per year. Twenty-one plants recently investigated consume 139,000 tons, and if all these were operated on the Edison system there would result a saving of about 57,000 tons, representing 1900 30-ton carloads. The isolated plant is coming over to the company's service with full appreciation of the savings effected, and in some cases the problem is solved by operating the isolated plant on the peak, carrying the rest of the load of the twenty-four hours on the Edison company. In this way the December load can be carried without extra investment by the company other than the ordinary service equipment.

OUR NEW ADDRESS

Beginning on Nov. 26, the publication and general offices of the ELECTRICAL WORLD will be at Tenth Avenue and Thirty-sixth Street, New York. The building at that location will be the headquarters in New York for the various publications of the McGraw-Hill Publishing Company, Inc.

Our friends will be welcomed most cordially at the new offices.

MEETING OF GOVERNORS OF ASSOCIATED MANUFACTURERS

D. C. Durland Resigns as Member of Board and Dana Bullen Named as Successor—R. K. Sheppard and J. R. McKee on War Service Committee

At a meeting of the board of governors of the Associated Manufacturers of Electrical Supplies, held at the general offices, New York, on Nov. 21 D. C. Durland resigned as a member. Mr. Durland withdraws from the board because of his resignation from the General Electric Company to become president of the Mitchell Motor Car Company. Dana Bullen, General Electric Company, was elected to succeed Mr. Durland as a member of the board of governors.

R. K. Sheppard, Simplex Wire & Cable Company, Boston, and J. R. McKee, General Electric Company, New York, were named by the board of governors to serve as representatives of the Associated Manufacturers of Electrical Supplies on the war service committee of the Electrical Manufacturers' Council.

ADMINISTERING SIGN ORDER IN THE CHICAGO DISTRICT

Commonwealth Edison Company Sends Garfield Regulation to 12,000 Sign Users—Spirit of the Requirement Obeyed

As the first step in assisting electric sign owners to obey the regulation of the United States Fuel Administration, the Commonwealth Edison Company of Chicago mailed a copy of the order to each of 12,000 electric sign users in Chicago. The company secured a complete list of electric sign users from Victor H. Towsley, chief electrical inspector, City Hall. Notices were sent to this number in spite of the fact that only about 10,000 of the signs are on the Commonwealth company service. As there was some delay in getting the order in Chicago, it has not yet been determined what the effect in coal saving will be. Judging from figures which were prepared showing that only 0.75 per cent of the coal used would be saved in case the entire electric sign load were discontinued, it has been observed that the effect will be very small. Patrolmen charged with the duty of reporting sign owners who violate the order say that the spirit of the order is being lived up to pretty generally.

REPORTS TO WASHINGTON ON SIGN-LIGHTING ORDER

National Fuel Administration Receives Advices of Some Violations, Which Are Being Investigated —Studying Effect of Conservation

Some violations of the sign-lighting order issued recently by the Fuel Administration are reported in advices from the Washington representative of the ELECTRICAL WORLD. Field agents of the Fuel Administration have been ordered to investigate the alleged violations, with a prospect that offenders will be prosecuted immediately.

It is stated at the office of the Fuel Administration in Washington that it is not known yet whether the alleged violations have been the result of accident or design, but that the Fuel Administration is keeping a close watch on those who are expected to obey the order and on the effect of the order. It is stated that not sufficient time has elapsed to show how much coal will be conserved as a result of the regulation, but that the Fuel Administration hopes to have a table ready within two weeks showing a certain amount of conservation. This table, it is stated, will be based on the amounts of coal power and lighting companies have been receiving during weeks before the order was issued and the amounts received since then.

Notwithstanding that the order is in force, arguments are still heard against it, based on what is happening. It is stated that in many cities noted heretofore for brightly lighted thoroughfares, which were the resort of promenaders in the evening, fewer persons are seen on the streets at night, with the necessary attending result that more lights are used in the interiors of homes and places of resort, which, it is stated, causes the use of as much if not more fuel than would be consumed in sign lighting under the old system.

In the city of Washington there are very few large electric signs of an advertising character. The Potomac Electric Power Company states that the cutting off of the signs and curtailment made necessary by the order means a loss of about $2,000 annually.

COMPLIANCE IN NEW YORK WITH SIGN-LIGHTING ORDER

Some Questions of Details Have Arisen in Enforcement of the Restriction, but They Are Being Worked Out

In New York City, where the volume of sign lighting due to the Broadway "white way" makes the order of Fuel Administrator Garfield of special interest, the new restrictions are generally complied with fairly. A number of detail questions have arisen as to the application of the order to moving-picture theaters, etc., but these are being worked out gradually.

ELECTRIC SIGN CURTAILMENT IN THE NEW ENGLAND STATES

Careful Inquiry Fails to Disclose Any Saving in Fuel So Far Which Can Be Identified as Due to Order

Central stations throughout New England complied promptly and patriotically with the order of Fuel Administrator Garfield relative to curtailment of electric sign service. In some cities and towns the public has not acted upon this order to the extent anticipated in the near future, but this condition is merely temporary. It has been found already that reduction of electric advertising display is increasing expenditures for newspaper publicity by merchants and other interests. Central stations have accepted the Garfield order in the spirit of full co-operation. A silver lining to the cloud of lost revenue from sign business is found in the increased amount of isolated-plant service now being taken over by central stations, on the basis, as one prominent utility executive puts it, of 5.5 lb. of coal per kilowatt-hour versus 2 lb. (the central station index of efficiency).

A careful inquiry by a representative of the ELECTRICAL WORLD fails as yet to disclose any saving in fuel due to sign curtailment which can be identified as such. The log sheets and daily load curves of several representative plants compiled before and after the institution of sign curtailment show nothing in the way of coal economy which can be attributed to the government's restrictive policy. On the Narragansett Electric Lighting Company system, Providence, R. I., the peak load fell at 6 p. m. from a maximum of 32,000 kw. to 26,000 kw. on two representative days prior to and subsequent to the order. The shape of the curves was practically identical. In this particular city a large number of small signs are in use which do not fall within the strict 7.45 p. m. to 11 p. m. burning period, and there are not so many spectacular signs apart from entrances and interiors of establishments as in some other places.

A comparison of station records at the Worcester (Mass.) Electric Light Company generating plant, for two "before" and "after" days, is given below. It will be seen that other conditions led to an actual increase of output and of total fuel consumption on the day

when sign curtailment was in force. As in Providence, it was impossible to detect on the station load curve any effect due to reduction in sign operation:

	Before Wed., Nov. 14	After Fri., Nov. 16
Three-phase energy generated, kw.-hr.	175,000	179,500
Peak load in kw. (5 p. m.)	14,600	15,400
Hours of service of generator units:		
No. 1. 4500-kw.	24	24
No. 2. 2000-kw.	11 h. 15 m.	11 h. 5 m.
No. 3. 2000-kw.	0	0
No. 4. 2000-kw.	1 h. 15 m.	1 h. 35 m.
No. 5. 4500-kw.	15 h. 50 m.	15 h. 50 m.
Kw.-hr. output of each unit as above:		
No. 1	88,300	90,000
No. 2	18,200	18,600
No. 3	0	0
No. 4	2,300	2,700
No. 5	66,200	68,200
Coal consumed, lb.	526,400	489,300
Coal per kw.-hr., lb.	3.01	2.73
Station load factor in per cent	42	48
Pounds water per kw.-hr.	20.4	20.4
Weather	Fair	Fair
Duration of peak in hours	1	1
Comparative loads (kw.):		
7.00 p. m.	7,700	7,600
7.30 p. m.	7,800	8,000
8.00 p. m.	7,400	8,100
9.00 p. m.	6,500	7,100
10.00 p. m.	5,400	5,100
11.00 p. m.	4,400	4,400
12.00 p. m.	3,100	3,100

On the day after the curtailment went into effect the actual total loads on the station just before, during and after the permitted hours of burning were greater than when the signs were in use *ad libitum*. The company advertised the order of Dr. Garfield in the local press and has cut off the service of its own large signs. It estimates a loss of sign revenues of about $3,500 per year.

On the Boston Edison system the effect of the curtailment cannot as yet be identified on station output curves. So far the variations of the weather have more influence upon the station output and coal consumption than the curtailment. It is estimated that the total annual income from electric signs on this system is about $150,000, and that the absolute shut-down of all signs would save about 3500 tons of coal yearly. The Fuel Administrator of Massachusetts, J. J. Storrow, has recommended that window lighting be curtailed from Nov. 19, as shown in the following bulletin:

TO ALL MERCHANTS:

At the instigation of the Mercantile Bureau of the Worcester Chamber of Commerce the retail stores in Worcester are putting into effect the following recommendations, commencing Monday, Nov. 19, 1917:

1. Turn off the lights in the show windows at 8 p. m. It is understood that if a store keeps open for business after 8 p. m. it will turn off its show-window lights at the time the store closes.
2. Discontinue all electrical advertising signs as directed by the government.
3. Make a general effort to reduce the amount of heat, light and power used in retail stores.
4. Do not turn on the lights in showcases until 10 a. m.
5. Discontinue all window lights on Sunday night.
6. Display the "Help Save Coal" posters issued by the Massachusetts Fuel Administration so as to inform the public of what the merchants themselves are doing, in the hope that the public will be sufficiently impressed with the necessity of coal conservation.

We strongly indorse these recommendations and ask the merchants of Worcester to co-operate with us by putting them into effect.

It is too early to discuss the effect of this recommendation.

CALIFORNIA NOT AFFECTED BY SIGN-LIGHTING ORDER

Federal Restriction Construed on Pacific Coast to Be Measure of Relief in Railroad and Coal Industries

The Garfield order restricting electric sign lighting has not affected California, reports the San Francisco correspondent of the ELECTRICAL WORLD, because the order is construed there to be a coal-conservation and freight-car-relief measure. In this territory all stand-by stations which carry peak load burn oil delivered from the oil fields by long pipe lines. Thus until there are further orders from Washington there will be no restrictions on the use of electricity for any purpose in the Northwest. In some of the Rocky Mountain States coal fuel is used, but even there the effect of the order will be very slight. The Puget Sound Traction Company, for example, estimates that out of 250,000,000 kw.-hr. only 30,000 kw.-hr. is used for display lighting, and most of this is during the hours permitted.

ACQUIESCENCE IN KENTUCKY IN SIGN-REGULATION ORDER

Curtailment Expected to Result, However, in Only Negligible Saving in Coal—Economy in "White Way" Systems

In Louisville as well as all over Kentucky there has been general acquiescence in the Fuel Administration's suggestion that electric signs be limited. On the other hand, the observation is noted that this curtailment will result in a negligible saving of coal. Donald McDonald, vice-president and general manager of the Louisville Gas & Electric Company, is quoted as saying that curtailment of service in Louisville will amount to little more than reduction in consumption of one ton of coal a day, if, indeed, that much, and the company operates its own mines. Several isolated plants have curtailed similarly, and there is a general disposition to heed the suggestion whether or no. Some smaller Kentucky cities are reducing consumption by turning off two or more lights in cluster standards of "white-way" systems.

WAR SURCHARGE FOR BYLLESBY COMPANIES

Minneapolis General Electric Company to Add 10 per Cent for Power Bills and 5 per Cent for Lighting Bills—Iowa Company Acts

The Minneapolis General Electric Company, one of the larger operating units of the Northern States Power Company, has announced an increase in service rates effective on Jan. 1, 1918. After that date a temporary war-condition surcharge of 10 per cent will be added to power bills and 5 per cent to lighting bills. The executive committee of the Minneapolis Wholesalers and Retailers' Association has approved this action by unanimous vote.

The Ottumwa (Iowa) Railway & Light Company has announced that a war-condition surcharge will be added to the rates charged for electric light and power and steam heat.

ANXIOUS TO KNOW WHAT ARE "LESS ESSENTIAL" INDUSTRIES

Forthcoming Priority Order in Transportation to Be Means of Controlling Supplies of Coal and Other Material

Washington is being deluged by anxious inquirers who desire to know, in behalf of industry generally throughout the country, just what the so-called "less essential" industries will prove to be, in the view of the government officials and the industrial leaders who are assisting them, when the forthcoming priority order in transportation is issued.

The understanding in Washington is, according to the Washington correspondent of the ELECTRICAL WORLD, that the forthcoming order will undertake to tabulate, or that there will be issued at the same time as the forthcoming order a tabulation of, all the industries of the country in what is believed to be their relative order of importance so far as prosecution of the war is concerned. It is believed to be certain that there will be a number of industries toward the end of the list which will be obliged to shut up shop, and that their labor and coal and in some cases material will be turned over, if possible or wherever adaptable, to industries essential in the prosecution of the war.

"EXCESS PROFITS ADVISERS" MEET DAILY IN WASHINGTON

Many Attacks on Excess Profits Provision of the War Revenue Law Reaching the National Capitol—Congress May Act

The "excess profits advisers" of the Commissioner of Internal Revenue are holding daily sessions in Washington in an endeavor to gather and tabulate information which will aid the Commissioner and the Secretary of the Treasury in administering the law. The Commissioner recently sent out more than 2000 letters to various trade and technical organizations of the country, among them the Associated Manufacturers of Electrical Supplies, asking for information which will assist in administering the law. This information is now being considered by the "excess profits advisers." It is being held confidential.

The board of advisers includes Representative Cordell Hull, member of the House ways and means committee, chairman; T. S. Adams, economist, Yale University; Wallace D. Simmons, president Simmons Hardware Company, St. Louis; J. E. Sterrett of Price, Waterhouse & Co., accountants, New York; S. R. Bertron of Bertron, Griscom & Co., bankers, New York; E. T. Meredith, editor *Successful Farming*, Des Moines, Iowa; T. W. McCullough, editor Omaha *Bee;* Stewart W. Cramer, National Council of Cotton Manufacturers, Charlotte, N. C., and Henry Walters, chairman Atlantic Coast Line and the Louisville & Nashville railways.

Vigorous attacks on the excess profits provision of the law are reaching Washington in every mail and are beginning to appear in important newspapers of the country, as lawyers, actuaries and others complete their analysis in the endeavor to advise clients how to pay their excess profits taxes. Commissioner of Internal Revenue Roper frankly admitted to the Washington correspondent of the ELECTRICAL WORLD that the Treasury Department expects considerable difficulty in administering the law, owing to what has been termed by some persons the ambiguity of its language. It is now expected in Washington that Congress will be obliged to straighten out some of the apparent inconsistencies by special enactment at the coming session.

TRANSPORTATION FOR THE NON-ESSENTIAL INDUSTRIES

Chairman Lovett Gives Assurance that No Industry Will Be Eliminated Without an Opportunity to Be Heard

Robert S. Lovett, chairman of the Priority Board, states regarding transportation of "non-essentials":

While the situation may change, yet I am not at this time contemplating any further action with respect to transportation of non-essentials. Priority Order No. 2, with regard to open-top cars, went as far as it seemed wise to go in dealing with that problem by restricting the transportation of non-essentials.

Conditions, however, will be constantly observed. Whether the coal shortage requires restriction of the coal supply of non-essential industries is a question for the Fuel Administrator, Dr. Garfield, to determine.

As to the War Industries Board, apart from my action under the priority act with respect to transportation, I may say that the industries of the country would seem to be justified in assuming from the action of the board in the matter of copper and steel prices, and its record generally to date, that it is the desire and policy of the board carefully and liberally to conserve the interest and welfare of industries.

I feel safe in saying that the board will take no action designed to eliminate any non-essential industry without reasonable notice and an opportunity to be heard.

LIMITATION OF COAL FOR NON-WAR PRODUCTS

Dr. Garfield Determined that Sufficient Coal for the War, for Public Utilities and for Domestic Consumers Shall Be Provided

This statement by United States Fuel Administrator Garfield was issued on Nov. 17:

If voluntary economy on the part of industrial and domestic consumers, added to the increased coal production of 1917, which will reach a total of over 50,000,000 tons, does not provide fuel enough for the war and to keep our people warm, there will come a time when some limitation will have to be imposed upon manufacturers of non-war products. In such an event the business world may feel sure that all the bearings of such limitations will be given thorough consideration and that the necessary coal will be obtained with the least possible interference with industry.

Arbitrary limitation is a last resort and to be avoided if possible. In many cases industrial concerns have already begun a voluntary curtailment of their use of coal. Such efforts will receive the fullest support and encouragement of the Fuel Administration, including technical advice on the use of fuel. The important point for every one to remember is that if coal is now consumed in the old "peacetime" way the supply will fall 50,000,000 tons short of necessary requirements in spite of the large increase in production. As I have stated before, the Fuel Administration is determined that sufficient coal for the war, for public utilities and for domestic consumers shall be provided.

The way to prevent those losses incident upon limitation of industry is for every consumer of coal to cut off waste and unnecessary consumption with an iron hand and to start on this intensive course of conservation without a moment's delay.

CAMPAIGN TO HELP THE ELECTRICAL CHRISTMAS

Society for Electrical Development Is Pushing Its Campaign to Draw the Attention of People to Practical Gifts

This year's campaign of the Society for Electrical Development, New York, in furtherance of "America's Electrical Christmas" is progressing. A book just published by the society, which is being sent gratis to members and non-members upon request, designed for central stations and dealers, is filled with practical suggestions for stores of all sizes in large or small cities.

WESTINGHOUSE AGENT-JOBBERS DISCUSS TRADE RELATIONS

At Hot Springs Convention This Week Association Members Expressed Belief That Now Is the Time to Develop Merchants

A three-day annual meeting of the Westinghouse Agent-Jobbers' Association was held at Hot Springs, Va., beginning on Monday, Nov. 19. Reports and papers were presented by members and guests of the association, taking up particularly questions having to do with the agent jobber's relations to his customer, the development of better merchandising relations in the industry and the definite relation of the Westinghouse Agent-Jobbers' Association to the better merchandising movement. Members of the association expressed the belief that now was the time to help to develop merchants in the industry, and a committee was appointed to devise ways and means to carry out a constructive program.

A complete plan of reorganization of the work of the association was outlined by the executive committee and adopted by the convention. The work of the association is to be carried on by an advisory board, of which Samuel A. Chase, Westinghouse Electric & Manufacturing Company, is chairman. The work of the board is divided into six subjects—advertising, supply, motors, sales methods, demand and production. Each of these subjects will be handled by two directors, one a representative of the Westinghouse company and one an agent-jobber. Associated with these directors under each subject is an agent-jobber as an adviser on a specific line of apparatus.

The lines of apparatus are as follows: Switches and protective apparatus, meters, transformers, insulation, railway accessories and line material, lighting apparatus and rectifiers, fans, heating appliances and motors. By this method there will be under each subject a committee of two directors seeking special information from an appointed group of advisers in the association.

Emphasis on the merchandising problems was given by a paper on "The Coming Merchant," by F. M. Feiker, editorial director ELECTRICAL WORLD, and in addresses and discussion by members of the association under the subject of advertising and sales methods.

"War and Its Obligations" was the subject of an address by Harry Dwight Smith, president of the Fuller & Smith Advertising Agency. An address was made by John J. Jackson, general attorney of the Westinghouse Electric & Manufacturing Company, entitled "Your Duty."

Attendance fines, as well as the entrance fees to the golf tournament, were contributed by vote of the association to the Red Cross and Young Men's Christian Association funds.

The officers for the coming year are as follows: President, J. C. Schmidtbauer, vice-president of Julius Andrae & Sons Company; vice-president, S. L. Nicholson, Westinghouse Electric & Manufacturing Company; secretary, A. J. Cole, vice-president McGraw Company; assistant secretary, P. T. Pritchard, Westinghouse Electric & Manufacturing Company; treasurer, J. E. McLeron, president Northwestern Electrical Equipment Company; counsel, John J. Jackson, Westinghouse Electric & Manufacturing Company.

NEW YORK CONTRACTORS HOLD LARGE MEETING

Attendance of 1500 Gathers to Hear Plans for Better Organization and to Listen to Exposition of Goodwin Plan

In order to learn how the industry might be strengthened and placed on a better business basis, more than 1500 electrical contractors and dealers of New York City and their guests gathered in the Madison Square Garden Theater on Tuesday evening of this week under the auspices of the local supply jobbers and the different local contractors' associations.

L. K. Comstock was chairman, and in opening the meeting laid emphasis on the need for co-operation in order to effect results. James R. Strong explained the new national constitution of the contractors' association and was followed by George L. Patterson, president of Stanley & Patterson, jobbers, who spoke on the topic "Ideal Relations Between Jobbers and Contractors."

A code of ethics, or what might be called a code of practice, was read by Fred W. Lord of the Lord Electric Company. Some reasons why a contractor should affiliate himself with a representative association were given by J. C. Forsythe of the New York Board of Fire Underwriters. G. E. Bruen of the Suburban Exchange of Fire Underwriters told briefly some plans for changing the method of inspections in favor of the contractor. A brief address bespeaking the desire of jobbers to co-operate in furthering any movement to better the industry was made by Charles P. Scott of the Royal Eastern Electrical Supply Company. The extent to which electrical associations have benefited and can benefit the electrical contractor was the theme of an address by Louis Kalischer, chairman of the advisory board of the Electrical Contractors' Associations of Greater New York.

In closing the program for the evening, William L. Goodwin presented the Goodwin plan for harmonizing the industry from the standpoint of organization. Mr. Goodwin went to great pains to impress upon his audience that private ownership of utilities was absolutely essential if there is to be progress. He called attention to the need for a stabilizing influence in the industry, pointing out the way in which this could be brought about by making a profit on all sales and by preferential discounts in accordance with the service performed.

KANSAS CITY INDUSTRIES RELIEVE POWER SHORTAGE

By Co-operation with the Central Station Company They Help to Tide Over Situation Resulting from Coal Shortage

Patrons of the Kansas City (Mo.) Light & Power Company, both power and light, with great good nature and a fine spirit of co-operation, have made personal sacrifices to help the company over a critical situation in its supply. While the company had supplies of coal to keep its plants operating, the Kansas City Railways Company, which furnishes the bulk of the energy sold by the light company, was seriously handicapped.

Late in October the situation became grave, with a supply on hand for less than a week and expected shipments delayed. It became necessary to curtail street car service and to cut down on power and light users radically to carry the service over until coal could be obtained. In this situation about twenty large power users suspended operations entirely over Saturday, Nov. 3. For months these and other power users had been adjusting their loads to the exigencies of service, working more at night, and for several days they had suspended work from 3.30 to 7.30 p. m. daily. On Nov. 5 these plants resumed operations on the shortened schedules, some of the needed coal for the railways company having arrived.

The critical time was from Friday, Nov. 2, to Monday, Nov. 5. The railways and the light companies planned to give a maximum of service to all patrons consistent with conservation of the coal supply. Electric railway cars were kept in operation with a reduction of about 10 per cent in service during rush hours and a reduction of about 40 per cent in the middle of the day. For a week the light company had been cutting out certain sections of the city for short periods in the evening, and on Friday, Saturday and Sunday several sections were cut out for half an hour or more during the evening peak load. The endeavor was made to distribute the inconvenience over the entire city at different times. There was very little complaint, the public having been fully informed of conditions making the procedure necessary by advertisements.

Merchants also co-operated in large degree. The local association adopted resolutions urging members to darken electric signs and windows between 5 and 7.30 o'clock and to reduce lights in stores as much as possible in those hours. Many merchants complied with this recommendation. The inconvenience has been relieved by warm weather and better gas pressure so that householders can use gas for cooking and lighting.

The heavy drain upon the supply of energy in Kansas City caused by additional demand in cooking, heating and industrial uses was considerably relieved on Monday, Nov. 12, when a new 3500-kw. steam turbine was put into use in the central station of the Kansas City Light & Power Company. Owing to coal shortage, the company was compelled to shut off energy from industrial plants and even residence districts during the rush hours of the Kansas City Railways Company, which furnished much of the light company's energy. With the new equipment this will be unnecessary, light company officials believe.

Four new 500-hp. boilers have been installed. These boilers had been promised last July, but stress of government business forced Kansas City to wait. Four new 750-hp. boilers are being installed now in the same plant to feed a new 9000-kw. turbine that will be put into place by Jan. 1, when the light company will relieve the railway company from a heavy load of energy which can then be used for electric railway service during rush hours.

In another twelve months the light company's new plant on the Missouri River in East Kansas City will be in operation, and the company then will generate energy for its entire demand for industrial and home consumption in Kansas City, Mo.

The agreement between miners and coal operators of the Southwest last week has had a quieting effect upon the consumers of electricity in Kansas City.

With continuation of moderate weather the light company officials feel that there will be a small reserve supply of coal. The company, therefore, is inclined to be more lenient with consumers. Many industries are now running up to capacity in use of energy, although there is still conservation in electric signs and during the rush hours of each workday in big industries.

LIGHTING AND COAL ON THE NEW JERSEY COAST

President Hazelrigg of the Atlantic Coast Electric Light Company Shows Why He Discourages "White Way" Lighting

Reports were published recently in newspapers of Asbury Park, N. J., that the Atlantic Coast Electric Light Company might have to discontinue operation because of coal shortage. It appears that the reports grew out of the unwillingness of the company to meet the desire of the city commission for special illumination of streets already lighted. The attitude of the company was based on the cost and scarcity of labor and materials and the importance of conservation of energy.

In view of the keen anxiety about coal conditions the ELECTRICAL WORLD asked the company what the facts are. S. F. Hazelrigg, the president, writes:

The rumor emanated from the fact that we had declined to take on a large number of additional street lights, the city insisting that we make a price per month, per year each.

A year ago we made the city a proposition for this lighting. The option on this proposition terminates with December this year. The city wished a price as above stated on the lamps for 1918. Since the proposition was made we are paying twice what we were for coal. Labor has advanced, so that as matters stand we could not consistently make anything but a safe proposition, which would be prohibitive, and in view of the difficulty in securing copper and other material we are not making any connections except those immediately on our lines; in other words, making no extensions.

When my letter was read before the commission the newspapers immediately wanted to know the reason, and in the talk which I had with their representatives I was quite frank about the coal situation, as we have been having trouble for a year in securing coal, not only in quantity but in quality. I repeated some testimony which I had heard personally given by the chief engineer of the Erie Railroad to the effect that that road was liable to shut down during the winter for the lack of coal. The interpretation which was placed on this statement was to the effect that we might shut down for the lack of fuel. From what I have recently noted in the papers and been advised by other concerns this is possibly true, but we are in no more danger of a shutdown than any one else.

HEAVY DEMAND FOR POWER IN NEW ENGLAND STATES

Coal Situation Makes Hydroelectric Energy of Great Importance, and Systems Are Besieged with Requests for Supply

The supply of power cannot keep pace with the demand for electrical energy in New England under present conditions, according to a recent survey of the field by the ELECTRICAL WORLD.

Some of the larger utilities have had to decline to accept power contracts which under normal conditions would have been taken over without difficulty and this applies to hydroelectric organizations as well as to steam plants. To add to the troubles of the central station manager, the coal supply is still on a hand-to-mouth basis for many of the smaller companies. The protracted period of fair weather is not helping to fill the large reservoirs at the headwaters of the electrified streams at a rate at all commensurate with the needs of the situation. One large hydroelectric company reports that its load at present exceeds the estimated output for this time by 15 per cent. Demands for secondary power flood the offices of the company after every rainfall, but of late there has been little precipitation.

CONSTRUCTION OF THE NATIONAL ARMY CAMPS

Major Junkersfeld Addresses Chicago Section, A. S. M. E., on Huge Job of Quartermaster's Department in Constructing Cantonments

At a meeting of the American Society of Mechanical Engineers, Chicago Section, on Nov. 16, Major Peter Junkersfeld told of his work in assisting construction of the original sixteen National Army cantonments and indicated something of the present task of constructing embarkation camps, warehouses, centers of assembly for material and hospitals to back up the National Army. The subject of electrical construction at the camps was dismissed with: "The camps are all electrically lighted and all pumping except at one camp is done by electricity." While troublesome experiences were recounted in connection with practically every other branch of construction, there was no intimation of difficulty in securing electrical supplies or in bringing the electrical part of the jobs to successful completion on time.

Major Junkersfeld stated that the average cost of a complete cantonment was about $8,000,000. This figures about $200 per man. The profit to contractors is a matter on which erroneous figures have crept out. Contracts were let on the cost plus profit basis—cost plus 10 per cent on the first $100,000, cost plus 8 per cent on the second $100,000, cost plus 6 per cent on the third $100,000, and a limit on the total profit of $250,000. As the contracts extended into enormous totals, the average contractor's profit was only 3 per cent. The average ratio of labor to material was as $1 is to $1. The lowest ratio was 70 cents to $1, and the highest was $1.40 to $1. The efficiency of labor was a great factor in determining the ratio.

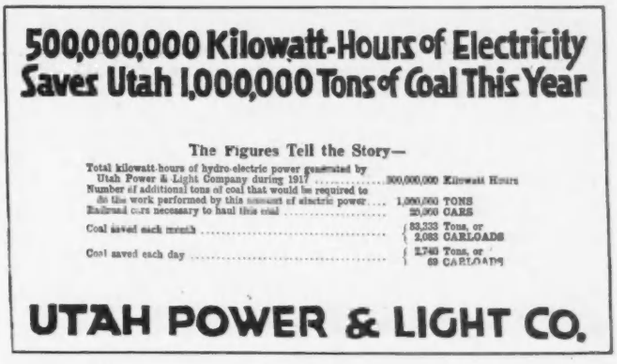
Major Junkersfeld praised the National Council of Defcnse, the American Railway Association and the National Committee on Gas and Electric Service for assistance rendered the Quartermaster's Department. He showed a number of lantern slides of the work and a motion-picture film to illustrate how one 200-man barrack was erected in two hours and fifty-five minutes.

HOW UTAH BENEFITS FROM ITS HYDROELECTRIC ENERGY

Utah Power & Light Company Shows that Its Water Power Means Saving of Coal, Transportation and Labor

The Utah Power & Light Company is advertising in the Salt Lake City newspapers to show how its hydroelectric energy saves coal.

The company shows further that the saving extends


500,000,000 Kilowatt-Hours of Electricity
Saves Utah 1,000,000 Tons of Coal This Year
The Figures Tell the Story—
Total kilowatt-hours of hydro-electric power generated by Utah Power & Light Company during 1917 ..... 500,000,000 Kilowatt Hours
Number of additional tons of coal that would be required to do the work performed by this amount of electric power .... 1,000,000 TONS
Railroad cars necessary to haul this coal ..... 20,000 CARS
Coal saved each month ..... 83,333 Tons, or 2,083 CARLOADS
Coal saved each day ..... 2,740 Tons, or 69 CARLOADS
UTAH POWER & LIGHT CO.

to the man power necessary to production, the use of the additional transportation facilities and men and of other workers used in distributing coal.

COAL OPERATORS AND ROADS PLAN CO-OPERATION IN OHIO

Pooling of Coal, Elimination of Waste in Transportation and Creation of Distribution Centers the Cardinal Features

At a meeting of coal producers and representatives of coal-carrying railroads in Cleveland on Nov. 14 plans for handling coal in Ohio were formulated which will probably increase the supply 25 to 30 per cent.

In the first place operators on railroads in Ohio and West Virginia will supply the points of consumption nearest them, instead of shipping coal all over a large territory and having their cars crisscross the States.

The second phase is pooling coal in important distribution centers. Coal of different kinds will be placed on separate sidings at these points and the first cars on each track will be delivered to consumers in consecutive order. Each consumer who has a certain number of cars on the track will receive that total, although it may be not from the mine ordered or the exact amount expected.

Pooling points decided upon so far are Cleveland, Toledo, Columbus, Cincinnati, Canton, Akron and Detroit. Others will probably be established.

A committee of Cleveland operators worked out a detailed plan of operation for that city, upon which others will be modeled. This plan was to have been presented to the Fuel Administrators of Ohio, Indiana, Michigan, Pennsylvania and West Virginia in Cleveland on Nov. 21.

CHANGES IN PERSONNEL OF ENGINEERING FACULTIES

Further Listing of Resignations, Leaves of Absence, Promotions and Appointments in the Electrical Teaching Body of the United States

Following is the second installment of the record of resignations, leaves of absence, promotions and appointments in the electrical engineering faculties of the various colleges and universities of the United States. The first installment appeared on page 878 of the ELECTRICAL WORLD for Nov. 3.

California Polytechnic School, San Luis Obispo, Cal.—C. A. Binns, former head of the department of engineering, resigned last August to accept a position with the General Electric Company in its San Francisco office. He was succeeded by A. R. Redman, who is a graduate E. E. of Armour Institute of Technology and who was for five years instructor in physics and electricity in the Los Angeles Polytechnic. He then went into commercial work as superintendent of the Arizona Power Company, Prescott, Ariz., later leaving to take a place as superintendent of the Santa Barbara (Cal.) Gas & Electric Company.

Colorado College, Colorado Springs, Col.—Prof. George B. Thomas is on a year's leave of absence, during which time he will work with the Western Electric Company along lines of interest to the military authorities. His work at the university is being carried on by G. B. McNair of the faculty of Kansas State University. N. R. Love has resigned from the faculty, where he had charge of the shop and some electrical courses, and is engaged in time-study work for the Denver Tramways Company.

Mississippi Agricultural and Mechanical College, Agricultural College, Miss.—G. W. Thaxton, who was an instructor last year, has accepted a government position in New York, and his place is filled by W. N. Scales of last year's graduating class.

Oregon Agricultural College, Corvallis, Ore.—W. D. Peasler, instructor in electrical engineering, has been commissioned a captain in the Officers' Reserve Corps and is now at Camp Lewis, Wash. He has been succeeded by J. A. Hooper, a 1917 graduate of the university.

Purdue University, Lafayette, Ind.—Prof. L. D. Rowell has been commissioned a captain in the Engineer Officers' Reserve Corps and is now in active duty as the recorder of the Board of Engineer Troops, Washington, D. C. J. B. Sheadel and H. E. Phelps, instructors in electrical engineering, have resigned, the former entering the service of the Union Traction Company of Indiana and the latter that of the American Telephone & Telegraph Company of New York. Emerson Pugh, Purdue 1916, has been obtained from the testing department of the General Electric Company as assistant in the laboratory. Prof. R. V. Achatz will take the place vacated by Prof. L. D. Rowell, in charge of all electrical laboratory work in the school.

Sibley College of Cornell University, Ithaca, N. Y.—Prof. W. S. Ford, who had charge of the senior electrical laboratory work, has left to accept a position as superintendent of power with the Vacuum Oil Company, Paulsboro, N. J. G. D. Floyd, instructor, left to join the Canadian Aviation Corps. A. R. Cota, instructor, left to accept a position under the Mexican government as inspector of manufacturing and generating light, heat and power plants. F. G. Tappan, instructor, left to accept a place as associate professor of electrical engineering at the University of Oklahoma. William Deans, Jr., instructor, left to accept a position with the Thomas Edison Company, East Orange, N. J. A. C. Stevens, instructor, left to accept a position with the General Electric Company at Pittsfield, Mass. These positions have been filled by the following instructors: J. B. Joyce and R. D. Elliott, who were graduated in electrical engineering from the Agricultural and Mechanical College of Texas, College Station, Tex., last June, and D. H. Banks, who is a senior in Sibley College and a graduate of Clemson College. W. C. Ballard of the department of electrical engineering has been promoted to the position of assistant professor of electrical engineering.

IDENTIFYING COVERING IS ADVOCATED FOR CONDUCTORS

Revision Voted by Electrical Committee of National Fire Protection Association—Action of Associated Manufacturers

At a recent meeting of the electrical committee of the National Fire Protection Association, it was voted that in the next edition of the National Electrical Safety Code Rule 26-A should be changed as follows:

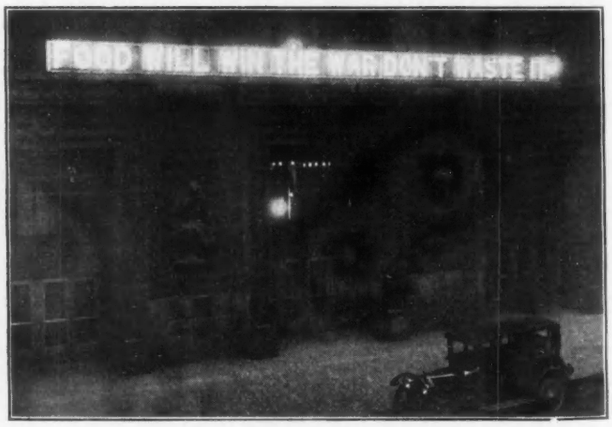
The neutral conductor of all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation and properly connected at all fittings to properly identified terminals in order to preserve its continuity. When one of the circuit wires is to be grounded, the ground connection must be made to this identified wire and as prescribed in Rule 15 and 15-A.

This rule will appear in the new edition of the code, to be known as the 1918 edition, and does not become effective until Jan. 1, 1919. As all fittings having wire terminals, such as sockets, receptacles, cut-out bases, attachment plugs, etc., must have some identifying mark to enable them to be connected easily with the proper terminal, the Associated Manufacturers of Electrical Supplies has submitted the matter to members of all sections covering the devices affected, asking that proper committees be appointed to consider the matter and report results at as early a date as possible, in order that they may be fully prepared for the new order of rules when in effect on Jan. 1, 1919.

ELECTRIC SIGNS HELP CONSERVATION OF FOOD

Commonwealth Edison Company Installs and Maintains on County Building, Chicago, Sign to Help to Win the War

Two large electric signs are being installed, one inside and one outside the Chicago city hall, at a cost of $5,000 to boost food conservation. These signs will flash in amber, scarlet and orange flames "Food Will Win the War." In addition daytime signs are being mounted on the outer walls.



FOOD CONSERVATION SIGN ON COOK COUNTY BUILDING

The Commonwealth Edison Company has installed over the county building a large electric running sign carrying the words "Food Will Win the War." This sign it has installed and maintained at its own expense.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Sign Lighting Order in New York.—The New York Public Service Commission, First District, has issued an order permitting electric companies to conform to the order issued by Dr. Garfield, Fuel Administrator, with respect to street electric signs. The order of the commission allowed the companies to file supplements to tariff schedules, and thus placed them in a position to obey the order of the Fuel Administrator. In order that the contemplated saving of coal might begin forthwith, the commission waived the usual thirty-day notice required for any change in tariff schedules and allowed the companies to act at once.

Advise Consumers of Most Advantageous Schedules.—A decision of the Colorado Public Utilities Commission in the case of the town of Manitou vs. Colorado Springs Light, Heat & Power Company holds that electrical energy for lamps installed by a private corporation around and on its property in the central portion of a town the charges for which the town has agreed to pay should be billed on the basis of the company's commercial lighting schedule, rather than on its street-lighting schedule, since the character of the service furnished by the utility, and not necessarily the nature of the installation of the consumer, should determine the schedule to which the consumer is properly entitled. Any and all schedules of a public utility should be available to any of its consumers who will comply with the terms and conditions of such schedules and pay the charges provided therein. On the other hand, it is the duty of the utility to advise its consumers under what schedule or schedules they may be most advantageously served. Had the record in this case shown that the town of Manitou selected the street-lighting schedule after being advised to the contrary by the lighting company, the case would have been dismissed.

Value for Sale Purposes and Value for Rate Making.—The Illinois Public Utilities Commission in an order authorizing the sale by the Stark County Power Company of its electrical property in Wyoming, Ill., to the Public Service Company of Northern Illinois, takes a definite stand as to the relation of valuation for sale purposes to that for rate making. The principal difference pointed out by the order between valuation for these two purposes is that capitalized earnings may be considered in sale cases but not in rate cases. The commission says in part: "In the fixing of a value for rate-making purposes the public is directly and vitally concerned that this value shall rest upon the firm basis of property values, although such property values should properly and reasonably give consideration to the intangible elements of value as well as to the more tangible elements. For rate-making proceedings the value under discussion is that upon which the utility is to be allowed its return, and it must be an equitable value as between the public and the utility. However, in a case of purchase and sale the public is not so vitally interested except to make certain that the property is not so crippled by indebtedness and fixed charges that its operation is precarious. The parties who are principally concerned are the purchaser and seller. . . . The seller in his determination of the value must take into consideration the revenues which he has received from the property and what he believes to be the possibilities for future revenues were he to retain the property under his control. The purchaser is governed by the revenues receivable from the property and by his opinion as to the possibility of developing these revenues in the future. . . . Under the laws existing at present, both parties must be largely influenced by the value of the physical property transferred, since the law clearly contemplates that the commission in fixing rates for utility service shall give primary consideration to the value of the physical property involved. . . . However, conditions may exist whereby the purchaser may feel warranted in the payment of an amount in excess of the physical valuation of the property, for the reason that the previous operation of the property may have been uneconomical and inefficient." The commission, however, though it permits the consideration of capitalized earnings in sale cases, specifically guards against their inclusion in future rate proceedings. "The commission cannot be bound in future rate-making proceedings by values permitted for purchase and sale purposes nor by amounts authorized for capitalization, since the value for rate-making purposes may differ in amount from the values previously determined for purchase and sale. However, the commission cannot in justice authorize the capitalization and the building up of a property account of a certain amount and at a later date decide that for rate-making purposes the value of the property should be diminished below this amount by large percentages, since by such action the commission would be creating an instability in utility property values and would be protecting neither the public nor the security holders." The commission authorized the purchase and sale of the property in question at the amount suggested, which was in excess of the physical value of the properties, but declined to permit the inclusion of the entire sale price in the property accounts and in the capitalization of the purchasing utility. The order required that the purchasing company amortize the difference between the fair value for purchase and sale purpose and the amount of the authorized purchase over a period of years.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contributory Negligence.—In an action to recover damages for the death of plaintiff's husband caused by coming in contact with high-tension electric wires maintained by defendant in one of its waiting rooms, held it was not an error to refuse to set aside the verdict in favor of defendant because of a finding that at the time the deceased came in contact with the wires he was not in full control of his powers of locomotion, it was held by the Supreme Court of Kansas (167 P. 1041). The lower court charged that if the deceased "failed on his part to exercise ordinary care, or in other words was guilty of contributory negligence in the premises and thereby contributed to his own death, then the plaintiff cannot recover," but the Supreme Court held that it was not error to fail to qualify the instruction by stating that the deceased was guilty of contributory neglifence if he voluntarily or of his own free will failed to exercise ordinary care. It was for the jury to determine under all the circumstances shown in the evidence whether or not the deceased was in the exercise of ordinary care at the time of the accident.

Reasonable Valuation.—What a telephone company is entitled to demand in order that it may have just compensation is a fair return upon the reasonable value of its property as a going concern, as distinguished from its physical value as a mere naked plant. This value is not obtained by adding up a number of separate items, but by taking a comprehensive view of each and all of the elements of property, tangible and intangible, including property rights, and considering them all, not as separate things, but as inseparable parts of one harmonious entity, and exercising the judgment as to the value of that entity, the Supreme Court of Oklahoma held (167 P. 995). Where, in a rate case against a telephone company whose lines extend throughout the States, it is charged that the exchange rates of a single municipality are unreasonable, the corporation commission in finding a basis for the adjustment of such rate should, as far as practicable, separate the valuation of the toll plant from the value of the exchange plant and equitably apportion between them the value of the property used in common in giving both classes of service. Where the evidence shows and the commission finds that the plant is kept in a high state of efficiency, and charges are made in rates for the purpose of counteracting or preventing depreciation by replacement, no necessity exists for building up a fund to be used for the purpose of counteracting purely theoretical depreciation.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Reorganization Plan Declared Operative.—The reorganization committee of the Northern Idaho & Montana Power Company has declared the reorganization plan operative.

No Cantonment Planned in Cuba.—Reports have been current that a cantonment would be built in Cuba. The Washington representative of the ELECTRICAL WORLD reports that there is no intention of building a cantonment in Cuba. This is also true of Porto Rico and other outlying islands.

Princeton Electrical Engineering Students in the War.—No students are enrolled this year for the electrical engineering course at Princeton University. Prof. Malcolm McLaren, professor of electrical engineering, writes in answer to an inquiry from the ELECTRICAL WORLD that all of the students have entered the national service to do their part in the war.

Competition in Electric Service Threatened at Toledo.—A resolution has been introduced in the Toledo (Ohio) City Council calling upon the Director of Public Service to have maps of the city light system prepared. Councilman Miller, who introduced the resolution, said that other companies will bid for the city light business if this information can be furnished.

Better Homes Exposition. — More than 150 manufacturers and dealers of the allied home furnishing and building trades will open on Nov. 28, lasting until Dec. 8, in the Klingman Furniture Exhibition Building in Grand Rapids, Mich., an exposition of furniture, house furnishing, house decorations, household appliances and utilities, household labor-saving devices, building material and a display intended to carry out the work of better home planning.

Liberty Bond Coupons to Pay Customers' Bills in Baltimore.—Announcement is made that the Consolidated Gas, Electric Light & Power Company of Baltimore will accept Liberty bond coupons in payment of customers' bills. The figures indicate that more than 90,000 Baltimoreans bought the second issue of Liberty bonds. This is one person in seven, and it is apparent that the day is fast approaching when there will be a Liberty bond in practically every Baltimore home. Each month almost every family living in Baltimore has a transaction with the Gas & Electric company. The first coupons will be payable on Dec. 15 for holders of the first Liberty bonds. In announcing the decision of the Baltimore company to take this action, John L. Bailey, treasurer, said that the company is doing everything possible to popularize Liberty bonds.

Prize Winners of Commonwealth Edison Section, N. E. L. A.—At the annual meeting of the Commonwealth Edison Section, N. E. L. A., at Chicago on Oct. 25, Samuel Insull awarded prizes for the best papers written by section members in competition during the past year, as follows: K. A. Auty, the Insull medal and first prize, $40, for paper on "Advertising Our Kilowatt-Hours"; second prize, G. B. Springer, for paper on "Underground Conduit Construction"; third prize, $20, Karl Horine, for paper on "Electrolytic Chlorine"; fourth prize, $10, R. L. Frisby, for paper on "Generation, Protection and Control." Prizes for the most meritorious suggestions made by employees were announced as follows: First prize, $50, J. P. Walsh, for recommending that when a meter is connected lights be tested and all burned-out lamps be replaced by new lamps; second prize, $40, to N. H. Johann, for suggesting that the company erect a pole on each station and donate a flag for each pole; third prize, $30, to H. E. Paaren, for recommending a new system of cutting off meters which are read and disconnected—that as men remove the house wire from its binding post they connect it to the neutral binding post, causing the house or flat to have two neutrals; fourth prize, $20, to F. E. Aurand, for recommending that a relief valve be placed in the exhaust end of the steam exciter at the various stations; fifth prize, $10, to L. M. Anderson, for the greatest number of accepted suggestions, eight of his suggestions having been accepted.

Battalion of Engineers for Gas and Flame Service.—The first battalion of American soldiers to meet offensively the gas and fire which the enemy introduced in warfare is being organized as the Thirtieth Engineers, Gas and Flame, with headquarters at Camp American University, Washington, D. C. The battalion is being recruited from the ranks of such civil professions and trades as chemical and mechanical engineering, explosive and gas manufacture, plumbing and carpentry and similar trades, and an exceptionally high grade of talent is volunteering. Major E. J. Atkisson, Corps of Engineers, a graduate of West Point and of Cornell, is in charge of organization. He has specialized in mechanical and electrical engineering, was formerly director of electrical and mechanical engineering, United States Army School, and was superintendent of locks, Panama Canal. It is announced that there is opportunity for a limited number of enlistments for the following classes of men: Chemists, gas engineers, plumbers, electrical experts, pipe fitters, interpreters, mechanics, chauffeurs, explosive experts, cooks, gas experts, blacksmiths, carpenters, clerks, and muscular, quick-thinking, resolute men, between the ages of eighteen and forty years, for pioneer soldier service of high character. Major Atkisson has announced that any man possessing the necessary qualifications may volunteer at any recruiting station of the country by asking to join the Thirtieth Battalion, Gas and Flame, forming at Washington.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Los Angeles Synchronous Club.—The second lecture of the Synchronous Club's electrical course on "Electricity and Magnetism" was given by Prof. J. C. Montgomery on Nov. 8 at the University of Southern California.

Electric Club of Toronto.—At its weekly luncheon on Nov. 9 the Electric Club of Toronto heard an interesting talk by Arthur Hawkes on "Relations Between Ontario and Quebec." On Nov. 16 Joseph E. Atkinson, president of the Star Publishing Company, addressed the members, his subject being "After the War—Industrial Changes."

General Glenn Speaks Under Auspices of Cleveland Electrical League.—On the evening of Nov. 16 General Edwin F. Glenn, commander of Camp Sherman, Chillicothe, Ohio, addressed a mass meeting at the Hippodrome, under the auspices of the Cleveland Electrical League. The address was for the purpose of increasing interest in the Y. M. C. A. campaign. General Glenn said he should not be surprised if France should have to withdraw from the conflict, to some extent at least, next summer, and that the weight of the war then may fall largely upon Great Britain and the United States. The league furnished many "four-minute" men, who addressed audiences in the motion-picture shows and at other places throughout the city during the week.

Railway Commissioners Meet.—At a meeting held at the Interstate Commerce Commission, Washington, D. C., the National Association of Railway and Utilities Commissioners elected the following officers for 1917-18: President, Edward C. Niles, New Hampshire; first vice-president, Charles E. Elmquist, Minnesota; second vice-president, C. M. Candler, Georgia; secretary, James B. Walker, secretary of the Public Service Commission, First District, New York; assistant secretary, Leroy S. Boyd, librarian Interstate Commerce Commission. Executive committee: C. M. Candler, Georgia, chairman; S. C. McChord, of the Interstate Commerce Commission; James C. Carr, New York; Alonzo R. Weed, Massachusetts; P. W. Dougherty, South Dakota; Edward C. Niles (ex officio), New Hampshire, and James B. Walker (ex officio), New York. President Niles announced the appointment of the special war committee created by the convention as follows: Max Thelen, California, chairman; Frank H. Funk, Illinois; Travis H. Whitney, New York; Joseph B. Eastman, Massachusetts; Ralph W. E. Donges, New Jersey, and Edward C. Niles (ex officio), New Hampshire. The association voted to hold its next meeting in Washington on Nov. 12, 1918.

David E. Howey has succeeded G. E. Tigner as superintendent of the St. Charles (Mich.) electric light and water works.

F. W. Bettys, who resigned as superintendent of the municipal electric light plant, Perry, Kan., last May, has been reappointed to that position.

Royal E. Frickey, for the last seven years electrical engineer of the Northern California Power Company at Redding, Cal., has resigned and has been succeeded by L. H. Kistler.

B. O. Millman has resigned as superintendent of the municipal light and power plant of Charter Oak, Iowa, to become connected with the Nebraska Gas & Electric Company at Genoa, Neb.

A. W. West, formerly engineer of design in the transmission division of the engineering department of the Georgia Railway & Power Company, has been promoted to be field engineer in the transmission department.

Herbert Berry, of the Gamewell Fire Alarm Telegraph Company, has been appointed superintendent of the Springfield (Mass.) fire-alarm signal system. He succeeds Samuel L. Wheeler, who recently retired after thirty-five years' service.

W. J. Swarting, who has been an engineer in the construction and operating department of the People's Power Company, Rock Island, Iowa, has been promoted to become superintendent of the People's Gas & Electric Company of Mason City, Iowa.

Sherman Creamer, Knowlton, N. J., has severed his relations with the Lehigh & New England Railroad to become connected with the Eastern Pennsylvania Power Company, Paulins Kill, near Warrington, Pa., as night superintendent at the power plant.

Prof. J. F. Wilson, who during the past year was professor of electrical engineering at Queen's University, Kingston, Ontario, was recently appointed assistant professor of electrical engineering at the University of Southern California, Los Angeles. Prior to going to California Professor Wilson was for five years a member of the engineering faculty at the University of Michigan. He is the author of a widely used dynamo laboratory manual, and a year or so ago he published an elementary text book on electrical engineering.

William S. Cone has resigned as manager of the United States Reclamation Service's Salt River project at Phoenix, Ariz., to form a consulting engineering partnership with Irving C. Harris, with offices in the Hollingsworth Building, Los Angeles, Cal. Mr. Cone was closely identified with the design and construction of several of the early hydroelectric installations of the West, including those of the Southern California Edison Company. Later he was associated with the late H. H. Sinclair in the Great Western Power Company's developments and subsequently was manager of the Sacramento district, later joining the Reclamation Service.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Matt B. Jones, general counsel of the New England Telephone & Telegraph Company, has been elected a director and vice-president of the company, with membership on the executive committee. He will take general charge of the company's affairs during the absence of President Philip L. Spalding, who was recently appointed a lieutenant-colonel in the signal and aviation branches of the government service.

H. P. Wood, head of the department of electrical engineering at the Georgia School of Technology, Atlanta, Ga., has been appointed president of the Academic Board of the United States Army School of Military Aeronautics, which has been established at the Georgia School of Technology. Professor Wood became assistant professor of electrical engineering at the Pennsylvania State College in 1901 and later was appointed to a similar post at the University of Illinois. In 1907 he was made professor of electrical engineering at the latter university. He was at one time engaged in electric railway construction at Washington, D. C., and was also with the New York Edison Company. Later he was superintendent of the East Side Electric Lighting Company in Detroit, Mich. Professor Wood has had experience with the Westinghouse works and has also done some installation work. Professor Wood is a fellow in the American Institute of Electrical Engineers.

E. Burt Fenton, formerly publicity manager of W. S. Barstow & Company, has been appointed publicity agent of the Northern Ohio Traction & Light Company, with headquarters at Akron, Ohio. Mr. Fenton "graduated" into the utilities field from the editorial desk of a daily newspaper, after serving eighteen years in that field. His first connection in the utility field was with the Sandusky Gas & Electric Company, for which he did the publicity work through two "municipal ownership" campaigns, the latter of which was followed by a very productive campaign of "good-will" advertising. In 1915 he was appointed publicity manager of W. S. Bartow & Company, in charge of the publicity work of the utility properties controlled by that company. He became temporarily associated with the Northern Ohio Traction & Light Company in August, 1917, and on Nov. 1 was appointed to his present position. Mr. Fenton is the author of "Snuggling Up to John Smith" and "The Missing Link," papers which have attracted wide attention in the utility field.

Obituary

E. L. Clyne, superintendent of construction of the Denver (Col.) Gas & Electric Company, died recently at his home in Denver at the age of fifty-five years.

Frederick W. Cole, for many years consulting engineer of the Gamewell Fire Alarm Telegraph Company, Boston, and inventor of many of the devices used in the company's system, died at Newton Highlands, Mass., Nov. 11. He was sixty years of age and had been in the employ of the company for the past forty years.

John Richmond, a native of London, England, and for a number of years past in the electrical business in this country, died at Great Barrington, Mass., on Oct. 22 after a prolonged illness. He was at one time manager of the Allis-Watson Company in New York City and later acted as electrical engineer for the American Laundry Machinery Company, with headquarters at Rochester. More recently he was employed by the Cutler-Hammer Company at its Bronxville factory as industrial heating engineer.

William Timothy Call, secretary and treasurer of the Gage Publishing Company, publisher of the *Electrical Record,* died last week in his home at 669 East Thirty-second Street, Brooklyn, N. Y., in his sixty-second year. Mr. Call was born in Bangor, Me. After leaving Bowdoin College in 1878 he came to New York and entered newspaper work. For a time he was a reporter on the *Sun,* and later he became editor of the *Boot and Shoe Weekly.* Twenty-five years ago, with U. W. Gage, he established the Gage Publishing Company.

John Gilmartin, superintendent of the meter department for the Detroit Edison Company, died at his home in that city on Nov. 12. He had been suffering with typhoid fever for three weeks. Mr. Gilmartin was a pioneer in electric meter work and at the time of his death was a member of the meter committee of the National Electric Light Association, chairman of the meter committee of the Michigan Section, N. E. L. A., and associate member of the A. I. E. E. Early experience was gained in Toledo, and from there he was called to Detroit, where he was put in charge of the meter department.

Henry R. Ford, vice-president of McCarthy Brothers & Ford, electrical equipment contractors, and one of the foremost electrical authorities in western New York, is dead. Mr. Ford was born in Lawrenceville, Pa., forty-six years ago and went to Buffalo in 1893. He became associated with Edmond D. McCarthy and organized the firm of which he was vice-president. Mr. Ford was a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Buffalo Engineering Society and many local clubs and organizations. He was also a veteran of the Seventy-fourth Infantry, N. Y. N. G., and an officer in the engineers' division of the Naval Militia of New York State.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

CREDIT SITUATION IS NOW UNDERGOING MARKED CHANGE

Conditions in Middle West as Seen by Delegates to Annual Meeting of Electrical Credit Association of Chicago

Representatives from Kansas City, Minneapolis, Indianapolis, Chicago, Milwaukee and other centers, speaking at the Electrical Credit Men's meeting at Chicago Nov. 15-16, all pointed out that the situation in the credit field is undergoing a marked change. At present there is practically no small building, but there are many large factories in process of construction. This takes from the electrical man's books the many small accounts he used to carry and supplants the many small accounts by a few large ones. It was urged that this situation should be watched. Moreover, the same condition of affairs has led certain contractors to put in overstock. Where this situation is discovered the contractor should be urged to reduce his overstock without sacrifice and to collect on the sale and meet his indebtedness. It seemed to be the general impression that it is a wise policy to urge customers with accounts against the companies to close out speculative stock so that credit lines may be well in hand against any possible slump.

JOBBERS' STOCKS IN THE EAST BEING REDUCED

No Tendency Noted Among Reliable Houses to Speculate—Incoming Stocks of Staples Are Small in Volume

Stocks in the hands of jobbers compare favorably as to variety and size with any preceding season of the year, except in connection with heating appliances and household specialties. A majority of dealers in this territory have responded to the public call by making every endeavor to keep a representative and adequate stock on hand.

Deliveries of appliances, etc., while possibly not meeting every expectation, are coming along, particularly from manufacturers and distributers operating in places accessible for better railway service. East of Pittsburgh the embargo has hindered prompt shipments, but it is figured that by the time the public has begun its holiday buying jobbers and dealers will be in a fair position to meet the unusual demand which is expected. The same conditions are reported as prevailing in connection with Christmas outfits and electrical toys.

With staple goods the supply of everything in the metal, glass and porcelain lines is reported to be short. Orders placed six and eight months ago at prices then ruling—much lower than present ones—are coming in, not in such quantities as was originally estimated, but in small lots—in driblets, as some jobbers expressed it—and in many cases by express, in order to avoid freight delays. Rigid-iron conduit, dry batteries, copper and steel specialties, etc., are on the list as being scarce and difficult to get in anything but small lots, and as going out as rapidly as received. This statement applies to pretty nearly if not quite all articles of a similar nature. Manufacturers are living up to former contracts, but in many cases under protest, owing to the difference in price. In not a few instances this is sharp. Lamps of certain sizes are lacking, which is ascribed by the manufacturers to the abnormal growth of exports as well as the domestic sale.

Building operations show no indication of a revival, and this affects the contractor and in turn the jobber. In spite of this drawback, however, trade has increased, owing in large measure to the demands of the government and the industries.

Inquiry as to whether jobbers or dealers were inclined to speculate in any line was replied to in the negative. Primarily, as far as the best known concerns may be quoted, there is no accumulation of stock. It would be impossible to get the merchandise if such a purpose were in view. Then, again, there is a tendency to reduce stocks preparatory to the yearly inventory, so as to free every dollar of capital to meet war and other tax obligations.

CONTRADICTORY CONDITIONS IN GUY ANCHOR MARKET

Certain Distributers Pessimistic Owing to Unsatisfactory Position of Raw Materials, Others Place Hope in Government and Export Demand

With the situation in guy anchors not altogether rosy in the view of several commentators, it is not altogether hopeless according to others. The former are inclined to rate the market on a par with everything else where malleable iron is the basic material. This applies to prices and deliveries, with the future rather hazy. Not being a stock proposition, factory readiness in material, producing capacity and definite shipping promises are vital considerations. The lack of new construction work is another reason offered why trade is not strong. Preparation in the way of additional strengthening and general repairing, in anticipation of the stress and strain incident to the winter storms, is almost normal.

On the other hand, an optimistic manufacturer of guy anchors avers that trade is better than it has ever been. Deliveries are made within thirty days and prices are advancing, so much so that all quotations are subject to change without notice. A heavy shipment was recently made to France on the order of a private customer. The improvement in domestic buying is ascribed to meeting the extraordinary demand from the military cantonments. It is this new outlet and the export trade, which was never had before, that are swelling the volume of sales. The same optimistic authority may be quoted relative to the lessening of repair work, which is charged up to the high prices of the necessary material.

EXPORTS OF ELECTRICAL GOODS FOR MONTH OF AUGUST

Indication of Government War Activities in Europe Evidenced by Marked Slump in Volume of Goods Shipped for Foreign Consumption

The exports of electrical merchandise from the United States in August last amounted to $3,607,278, as compared with $3,601,518 in the preceding August. While there was an increase in the value of exports, this was so slight as to show, in view of the number of price increases which have gone into effect during the year, that the volume of electrical merchandise exported in August last was undoubtedly somewhat less than that exported in August, 1916. About this time the government began to be very actively employed in transporting troops and war materials to Europe, as was later reported, and for that reason the supply of bottoms available for export was considerably less than formerly. This figure for August last was considerably less than for the preceding months of the year, but, knowing conditions in transatlantic shipping, it was to be expected.

Some items, particularly those strong in war demand, such as batteries, the use of which in the trenches is very large, and tungsten lamps for industrial purposes, showed an increase over August of the preceding year. With one or two exceptions all other articles showed decreases. For the first eight months of 1917 the exports in electrical goods had amounted to $36,032,820, as compared with $23,536,406 for the first eight months of 1916 and $14,976,659 for the first eight months in 1915.

Considering the extent to which exports have fallen off and considering also the government restrictions on exports, it is doubtful if the total value of electrical exports for the current year will exceed $50,000,000 by any considerable amount. In fact, it would not be surprising if the figure for the current year lay between $45 000,000 and $50,000,000.

Articles	1916	1917	1916	1917
Batteries	$161,513	$242,668	$1,174,003	$2,380 382
Carbons	.....	137,055	.....	239,883†
Dynamos or generators.	216,626	155,029	1,021,419	1,611,221
Fans	34,333	42,736	231,638	421,772
Heating and cooking apparatus	.....	22,174	.....	45,469†
Insulated wire and cables	406,526	389,909	2,498,372	4,717,837
Interior wiring supplies, including fixtures	80,707	111,961	574,784	865,051
Lamps:				
Arc lamps	1,672	486	11,964	12,222
Carbon - filament lamps	3,747	18,063	64,029	131,369
Metal - filament lamps	107,571	178,457	980,098	1,808,175
Magnetos, spark plugs, etc.	.....	202.680	.....	472,621†
Meters and measururing instruments.	89,579	69 955	538,847	696,275
Motors	402,489	136,232	3,139,275	4,130,170
Rheostats and controllers	.....	18,762	.....	32,963†
Switches and accessories	.....	123,546	.....	300,598†
Telegraph apparatus, incl. wireless	25,488	47,735	110,090	452,644
Telephones	124.234	118,551	1,147,860	1,388,487
Transformers	107.619	95,311	698,684	949.990
All other	1,839,414	1,195,968	11,345,343	15,375,691
Total	$3,601,518	$3,607,278	$23,536,406	$36,032,820

† Figures cover period beginning July 1.

METAL MARKET SITUATION

Copper Still a Mystery on Futures—Resales, if Any, Are Under Cover—Aluminum Advances

Apparently no change has occurred in copper conditions. The metal, so far as reliable reports are dependable, continues scarce, although it is reported that an easier supply will be available along toward the first of the year. The much-talked-of government resale arrangement between buyers and sellers has not yet been announced. Further, it is declared in some quarters, producers are not selling 100 per cent of their output, though they declare that no copper for November or December delivery is for sale. On the other hand, usually accepted authorities insist that a shortage is in sight.

Otherwise the only differences in price pertain to lead, spelter, tin and aluminum, the latter scoring a sharp advance. In old metals the market is stagnant.

NEW YORK METAL MARKET PRICES

	Nov. 12	Nov. 19
Copper:	£ s d	£ s d
London standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	30.00 to 31.00*	30.00 to 31.00
Lead, trust price	5.50	6.25
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.50 to 8.05	7.32½ to 8.05
Tin, Straits	71.00	75.00
Aluminum, 98 to 99 per cent.	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire	22.00 to 22.50	22.50 to 23.00
Brass, heavy	14.15 to 16.00	14.50 to 16.00
Brass, light	10.50 to 11.25	10.50 to 11.50
Lead, heavy	5.25 to 5.75	5.25 to 5.75
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

THROUGHOUT the Pacific Northwest and on the Coast business continues strong, with no sign of abatement. Shortage in lamps continues and the sale of energy-consuming devices promises to be large. A number of new enterprises, with large capital, are being projected which will call for a quantity of electrical apparatus and general equipment. The new sign-lighting order does not affect California's public utilities, oil instead of coal being used to carry the peak. Freight embargoes are not interfering seriously with the delivery of electrical goods.

In the Eastern, Middle and Southern sections the most active selling is reported in connection with governmental utilities—military camp and cantonment equipment. Labor disturbances are being adjusted on a basis that promises to be permanent during the continuance of the war. The demand for merchandise in all lines is excellent, with deliveries showing a slight improvement.

NEW YORK

The dominant note in the local market is the continuing uncertainty of deliveries in nearly every line of electrical merchandise. At present no relief is even predicted, the Eastern freight embargo upsetting all calculations. Notwithstanding this, the trade is not at all discouraged over current sales, reporting a state of business that is by no means small or unprofitable.

Collections almost universally are described as up to the mark, with so few delinquents as to be about negligible. Credits are therefore being held along firm lines.

CONDUIT.—Deliveries continue to be backward. In fact, so far as this territory's supply goes, conduit comes in by "fits and starts." Whenever the embargo against Eastern points is lifted temporarily a few carloads slip into the market, and then it is completely shut off.

LAMPS.—The situation is the same so far as deliveries and prices are concerned. Jobbers report a shortage in all sizes, particularly on automobile lamps. An order placed for standard grades for export eighteen months ago is still on delivery. One of the leading factories declines to supply any lamps for export.

FREIGHTS AND SHIPMENTS.—When goods are sent forward in car lots there is a better chance of the shipment being delivered in this section than on orders. The latter are likely to be held back at almost any point, and their final arrival at destination is extremely uncertain. The delays are reported as bound to affect the ultimate selling price.

SOCKETS, ETC.—Jobbers' stocks are said to be fair on sockets, as well as other schedule material. Porcelain sockets are slightly improved on delivery compared with the condition a month ago, and much better than they were three months since.

LAMP CORDS, FLASHLIGHTS.—The lamp-cord condition is mentioned as being very unsatisfactory, with stock limited and difficult to obtain. Flashlights are in a somewhat better position all around.

HOUSEHOLD SPECIALTIES.—Deliveries are being made in probably smaller lots at this time than was anticipated when orders were placed. With the approach of the holidays and the seasonable pressure incident to the greatly increased demand for every article so classified, perhaps the manufacturer and distributers may speed up. The time is drawing near when orders cannot be positively promised for delivery before the first of the year, and the outlook is for a scramble for merchandise on the part of jobbers and dealers. No immediate change in price is figured upon, unless a premium is given for expedited deliveries.

COLLECTIONS AND CREDITS.—Jobbing houses and general distributers are apparently satisfied with the regularity and promptitude with which the trade is meeting its bills. Credits are still carefully viséd and not allowed to run at loose ends.

CHICAGO

The heating device merger, involving as it does two Chicago factories and three Chicago sales organizations, is a live topic of discussion in the trade. The jobbers are frankly glad to hear of the merger and anticipate that it will be a good thing for them. They are particularly well pleased that the merger plan contemplates only one sales force for the Edison Electric Appliance Company. However, it is devoutly hoped that the jobbers' discount will be rearranged so that they will have an opportunity to make a profit on small orders, which they have not been able to do in the past. Viewed from the angle of stock, the merger will be seen again to benefit the jobber by reducing, in some degree at least, the number of lines he must carry.

The general business of the trade in the last week has been about normal as to volume. In a few lines prices have been a trifle weak. Credit men are watching the contractor risk more closely for overstock and are trying to find ways to collect money from the government promptly.

RUBBER-COVERED COPPER WIRE.—The majority of jobbers are on a 34-cent base, but during the last week one or two manufacturers came into the market offering some rubber-covered wire at 32 cents.

CONDUIT.—At least one jobber in Chicago has a fair stock of conduit. He states that this is all top-market goods, however, since he was able to secure it only by going into the open market and buying conduit when he became suspicious that his protective orders were not going to afford any protection to him. In some cases jobbers are now buying conduit from contractors. The hardest size to get seems to be 0.75-in.

SHIPMENTS.—Some of the shipments coming in from the East are slow on account of embargoes. This trouble, however, has not yet become serious.

ICE MACHINERY.—The local ice factories are beginning repairs and new construction for the next season, and new companies entering the ice business are placing orders for equipment. This market has been especially lively in the last week and promises to continue so for several weeks to come.

AUTOMOBILE SPECIALTIES.—The past season has been one which could be called merely fair for the automobile specialty departments of Chicago jobbing houses. The general condition of uncertainty in the automobile business accounts for this.

ELECTRIC RANGES.—One manufacturer reports that the sale of ranges during the month of November will nearly equal that of the average midsummer month. This confirms the statement that ranges are salable in winter as well as summer. The demand for hotel-type equipment is on the increase.

STORAGE BATTERIES.—There is a rumor abroad in the trade that the prices of storage batteries will be decreased in the near future. The decreasing price of lead is responsible for this change.

INDUCTION MOTORS.—Deliveries up to 30 hp. are being made out of stock by one manufacturer, and on sizes larger than this it is possible to get three weeks' delivery on certain machines.

BOSTON

No signs of a recession are to be seen in the electrical trade at this time. Jobbers continue very busy, and while little new building is in progress, industrial and government work show no abatement. The labor situation has cleared somewhat during the week, although several strikes involving electrical workers are still in effect. Labor has returned to service as a patriotic duty on most of the important government jobs. At a war conference of the New England branch of the National Metal Trades Association held here Friday of last week a vigorous attack was made on the closed-shop program of certain labor interests. This attitude is obstructing the production of munitions and other war material. Great encouragement was given to the advocates of the open shop by the setting forth of experience in Connecticut and in England.

Jobbers are well stocked, prices remain firm, and collections are reasonably good. Many concerns report record-breaking gross business. Though net profits do not measure up accordingly, the shrinkage is widely accepted with cheerful patriotism as a part of the war contribution of concerns and individuals.

COLLECTIONS.—Jobbers report that collections from industrial houses buying equipment and supplies in quantity are excellent. Small contractors are not in so favorable a situation, the route between buyer and seller being less direct and sometimes distorted by war conditions.

WIRE.—Price conditions are rather unsatisfactory, but one manufacturer of long standing believes that prices will become more stable when the government has had the opportunity to give more attention, as in the steel industry, to copper economics. Rubber-covered wire is quoted at 34 cents and weatherproof at 30 cents, with an irreducible minimum of three months on industrial deliveries not prepared to exhibit priority claims.

APPLIANCES.—The volume of business is very good indeed, especially in the higher-class heating equipment. Stocks are in fair shape, but deliveries are affected somewhat by the railroad congestion with which this section is struggling. No change in price prior to Jan. 1 is apprehended, but labor is pretty short and materials do not show any tendency to soften in price. Considerable interest appears in washing machines and vacuum cleaners.

SWITCHES.—A representative manufacturer shipped the largest output in his history last month. Prices show no increase, labor conditions are reported as very good, and heavy government orders are the rule. The railroad situation is one of the most trying conditions, as seen from the angle of the New England manufacturer with a continental or a cosmopolitan market. Raw material is spotty in its availability.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are very active, and government business is occupying the attention of dealers to a large extent.

ASBESTOS AND EBONY BOARD.—Production is oversold with prices unchanged. Commercial deliveries on ⅝-in. to 1.25-in. ebony board rule at from two to three months; on sizes under ½ in., from three to four weeks. On asbestos board four to five weeks are quoted. The capacity of the Johns-Manville plant at Nashua, N. H., has been doubled lately with respect to ebony board and sanding wood.

ELECTRIC RADIATORS.—These are moving slowly at present, owing to continued mild weather.

PORTABLE LAMPS.—Trade is improving, and increased sales for Thanksgiving demand are reported. Prices are ruling firm with little prospect of immediate change. Deliveries are better than heretofore except on high-grade glassware.

ATLANTA

Underlying conditions are good, and general business continues strong. Figures covering building reports from the larger cities of the country indicate that the Southeast is especially active, even in the face of high material prices and scarcity of labor. The inability of builders to secure structural steel has curtailed even greater activity in office building construction, and the necessity of the war needs having priority over building orders is influencing to some extent activity in certain lines. In an industrial way the Southeast is doing more than it ever did before.

During the last week twenty new industrial corporations were organized with minimum capital stocks aggregating $1,000,000.

The Builders' Exchange of Atlanta is progressing rapidly with its plans for the "builders' display." This display will occupy two floors of the Rhodes Building and will feature the work and products of the numerous members of the Builders' Exchange. The electrical fraternity will be well represented by the displays of the large manufacturers, jobbers, dealers and contractors.

The jobbers are tightening credit on a few contracting concerns that have ridden in on the wave of rapid industrial expansion and abnormal conditions and have shown little

knowledge of the present economic situation. The jobbers realize that over-expansion at this time and a drop in material prices later would play havoc with all concerned.

TEXTILES.—More activity is shown in this line this week, as indicated by a number of proposed new structures and additions. The new duck mill at the Atlanta federal prison is now under construction, prison labor being utilized. Present plans call for 500 to 600 motors, aggregating 1800 hp. It is expected that this mill will be in operation by Aug. 1, 1918, the government, of course, securing preferential shipment on motors and machinery. Energy will be secured from the Georgia Railway & Power Company, Atlanta. The Chatham Manufacturing Company, Elkin, N. C., has plans for an additional mill, which calls for $200,000 worth of machinery. The Barker Cotton Mills, Pritchard, Ala., are also planning the expenditure of approximately $100,000 for additions. Considerable activity is noted in hosiery mill construction. Electric power will be used in the new Mount Airy Hosiery Mills, Mount Airy, N. C. The Holly Bush Hosiery Mills Company, Holly Bush, N. C., has just been organized, and the Davis-Alcott Hosiery Mills, Gadsden, Ala., are installing additional electric equipment.

DRY BATTERIES.—There is no let-up in the demand for these, it being almost impossible to fill orders. No improvement in deliveries is expected until the present freight congestion at the larger Eastern cities loosens up.

FLASHLIGHTS.—The call for flashlights is very large, and while a sufficient supply of cases is on hand, no batteries can be had to fill them. This general situation follows closely that of the dry cells mentioned above.

HEATING APPLIANCES.—During the summer months the volume of sales in appliances lagged somewhat, but beginning with the fall weather and up to the present time this line has been on the boom. One manufacturer, who carries a very complete line, reports that the volume of his sales for the Southeast to date has broken all records. Reports from a number of jobbing sources indicate an unprecedented business for the year. Flatirons are still the most popular appliance. The South is realizing more and more the advantage of electric devices, and heaters that in the past grew shopworn cannot be kept in stock now, even for display purposes. Activity is not confined to a few articles, but is reflected in shaving mugs, curling irons, percolators and round grids. Deliveries are in pretty good shape, and local stocks seem to be able to take care of the situation.

SEATTLE

There is no noticeable increase or decrease in sales during the week. Business with shipyards, mills, industrial plants and government utilities continued strong and with no evident signs of abatement. Shortages along the lines previously mentioned are still causing considerable worriment. Shortages in lamps are particularly acute. This includes automobile lamps. The demand for lamps is increasing constantly, owing to the prevalent foggy winter weather and short days. The sales of farm lighting plants during the past week have dropped off appreciably. It is believed now that while sales along this line will be satisfactory, they will not come up to predicted expectations.

Washing machines and appliances are moving well, and dealers are expecting a volume of increasing sales between now and Christmas. Electric sewing machines particularly are moving well, and this line is expected to boom preceding the holidays.

Power and lighting companies throughout the Northwest, particularly those located in the outlying districts, are waging an advertising campaign with a view of increasing Christmas sales of energy-cousuming devices. Public utility companies in Seatle, Tacoma and Portland are expected to begin advertising and pushing sales of appliances the latter part of November, as will department stores and jobbers.

Seattle dealers during the week received an inquiry for a large number of tailors' electric irons, ranging in weight from 9 lb. to 20 lb., to be used at the American Lake cantonment, near Tacoma. Orders are still coming in from cantonments for lighting equipment and fixtures.

Business building in Tacoma is showing considerable life, several structures, including two or more apartments, are projected and under way. There is no change in the situation in Seattle, Portland or Spokane. Smaller buildings in the outlying districts show a slight increase. Three power and lighting companies, two in the Puget Sound district and one in eastern Washington, contemplate early extension work.

A very conservative source of information states that a steel plant for Seattle or the immediate vicinity is assured. The project is backed by Seattle, Alaska and San Francisco capital. An ultimate investment of $25,000,000 is promised. Several other industrial enterprises of far-reaching importance are projected.

Lumber production during the week is reported to be 84 per cent of normal, and orders are within 95 per cent of normal.. The settlement of the telephone strike in Washington and Oregon, which has continued for two weeks, is believed near, with the opening of a peace conference in San Francisco.

The car service commission of the railroads' war board issued a general order to all transportation lines insisting upon the strictest economy in hauling cars. The freight situation locally is no better. It is reported that Oregon expects an embargo on shipments of rough lumber among other things. Seattle jobbers report shipments are coming through from the East in a fairly satisfactory way, everything considered. Stocks are being watched very carefully, and annual inventories are being taken.

SAN FRANCISCO

Because of the weather, which continues fine and clear toward the end of November, together with the pressure of important problems, there has not been much thought of Christmas goods on the part of consumer or dealer, although jobbers, in anticipation of a heavy Christmas demand and slow deliveries, placed their orders some time ago. There is now speculation as to whether heavy Christmas orders will come suddenly or whether holiday buying will be lighter than usual.

A material factor in California conditions is the recent fixing of foodstuff prices by the federal authorities. This assurance of continued profit to farmers has brought the power companies considerable business in small pumping and other farm loads. All available irrigable land is being brought under cultivation, and the demand for extensions to small consumers is now the business of the day rather than the construction of expensive trunk lines on the initiative of the power companies.

The Garfield order curtailing electric sign lighting is not effective in California, it has been decided by the Railroad Commission, because oil, instead of coal, is used there to carry the peak.

The freight car embargo, which has seriously affected business in many lines in the West, has not yet been felt seriously in the case of electrical supplies. Prices remain unchanged, and, on the whole, deliveries and stocks are not fluctuating.

CREDITS AND COLLECTIONS.—Collections continue to be in remarkably good shape, the jobbers report; and it is believed that this is in large measure due to the educational work that has been going on among contractors and dealers, fostered by their own associations.

METERS.—The demand for meters has beeen active recently, and although much of this business is on a contract basis, there has been some competition on terms of delivery. Delivery varies greatly from five weeks to four or five months. Stocks on the Coast are in fair shape.

LAMPS.—The lamp situation, described as rather tense, remains unchanged. So long as no large orders that are urgent come in, actual needs can be handled satisfactorily.

SMALL MOTORS.—Fuel-oil producers have complained to the fuel conservation committee that the increase of oil production has been hampered by the delay in getting motors. As a result the matter has been referred by manufacturers to the Priority Board, and it is hoped that the motor situation will be improved.

Current Prices of Electrical Supplies

NEW YORK AND CHICAGO QUOTATIONS

The prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers.

The variation in prices may be due to the difference in grade of products made by different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.& S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single Conductor

No. 14 Solid
Less than coil.....List net to $61.00
Coil to 1000 ft.....—5% to $59.17

No. 12 Solid
Less than coil.....List net to $71.00
Coil to 1000 ft.....—5% to $68.87

Twin-Conductor

No. 14 Solid
Less than coil.....List net to $105.00
Coil to 1000 ft.....$70.00 to 10%

No. 12 Solid
Less than coil.....List net to $135.00
Coil to 1000 ft.....—10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid
Less than coil.....List to +10%
Coil to 1000 ft.....List to —10%

No. 12 Solid
Less than coil.....+10%
Coil to 1000 ft.....—10%

Twin-Conductor

No. 14 Solid
Less than coil.....List to +10%
Coil to 1000 ft.....List to —10%

No. 12 Solid
Less than coil.....+10%
Coil to 1000 ft.....—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....10% to list net
1/5 to std. pkg.....15% to 20%
Std. pkg.....34% to 38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....+20% to 12%
1/5 to std. pkg.....List to 20%
Std. pkg.....30% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31 to .3175	.32 to .3275
Barrel lots	.28 to .2875	.29 to .2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. s. stp.	$75.00	$66.00 to $69.75
⅜-in. d. stp.	75.00 to 78.75	68.25 to 72.00
½-in. s. stp.	100.00	88.00 to 93.00
½-in. d. stp.	100.00 to 105.00	91.00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.75
⅜-in. double strip	78.75	71.25-71.75
½-in. single strip	100.00	85.00
½-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.— $25.00-$55.00	$20.50-$24.75	$20.00-$22.00
¼-in.— $28.00-$60.00	$22.50-$27.00	$22.00-$24.00

NET PRICE 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.— $36.67-$55.00	$27.50	$24.75
¼-in.— $40.00-$60.00	$30.00	$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼	$0.0[illegible]½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.60
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 500 lb.	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	3.3% to 4.8%	6.3% to 7.8%
2500-5000 lb.	5.3% to 6.8%	8.3% to 9.8%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....$5.00 to $6.00
Discount.....25% to 30%

CHICAGO

List.....$5.00 to $6.00
Discount.....25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.27
60-watt—B	100	.36
100-watt—B	24	.65
75-watt—C	50	.65
100-watt—C	24	1.00
200-watt—C	24	2.00
300-watt—C	24	3.00
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.50
25-watt—G 25	50	.50
40-watt—G 25	50	.50
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.72
Round bulbs, 4⅝ in., frosted:		
100-watt—G 35	24	1.05

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $33.98
Coil to 1000 ft.	25.50 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$36.56
Coil to 1000 ft.	27.42

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list.	25% to 37%	20% to 32%
$10.00 to $50.00 list.	42% to 45%	37% to 40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $20.54
1/5 to std. pkg.	14.80 to 19.24

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75 to net
1/5 to std. pkg.	15.60 to 20.75	24.20 to net

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to 11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	15% to 20%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to net
1/5 to std. pkg.	List to —15%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List net to + 5%
$10 to $25 list	Net to 11%
$25 to $50 list	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	10% to 16%
$25 to $50 list	14% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	List to +5%
$10 to $25 list	List to —11%
$25 to $50 list	List to —14%
	Low Grade
Less than $10 list	List to —5%
$10 to $25 list	List to —16%
$25 to $50 list	List to —24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	16%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to —30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List to list net	List to +10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼ to $0.65
No. 18, full spools	0.43¼ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.65
No. 18, full spools	0.50½ to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00-$14.00	$11.25-$12.00
12	23.25- 27.09	21.30- 23.22	19.35- 20.85
10	32.40- 37.80	29.70- 32.40	27.00- 29.25
8	45.70- 53.34	41.90- 45.73	38.00- 41.38
6	72.40- 84.42	66.35- 72.35	60.30- 65.50

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00	$13.50	$12.00
12	27.36-27.37	23.41-27.37	21.88-23.46
10	38.15-38.25	32.40-32.72	29.97-30.60
8	53.83-54.27	46.14-46.43	42.29-43.42
6	85.19-92.61	60.85-79.23	54.76-74.09

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $40.00
25 to 50 lb.	35.25 to 39.00
50 to 100 lb.	34.25 to 38.00

CHICAGO

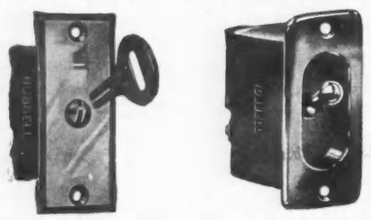
	Per 100 Lb. Net
Less than 25 lb.	$40.00 to $40.50
25 to 50 lb.	39.00 to 39.50
50 to 100 lb.	38.00 to 38.50

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Toggle Switch

Automobile toggle switches designed with a view toward effecting an improvement over the existing forms of switches for automobile use, such as those employing the miniature push button, or the single-plunger type,



TOGGLE SWITCHES FOR AUTOMOBILES

which consists of pulling out and pushing in a small handle, have been developed by Harvey Hubbell, Inc., of Bridgeport, Conn. The makers claim that the toggle, or lever or tumbler form of switch, as it is variously referred to, is the most convenient form for operating in an automobile. To throw on the current the toggle handle is simply pushed up, and the reverse operation opens the circuit.

Another feature pointed out is the indicating arrangement of the toggle. To the user of the switch it becomes second nature to press the handle up to turn on the lights, and down to turn them off. These switches have sufficient carrying capacity to carry the load of almost any battery or magneto circuit and have successfully withstood tests as high as 50 watts. The interior mechanism is very simply and strongly made. The switches can now be furnished in single-pole and three-way types with flush plate, single-pole and three-way with recessed plate, momentary-contact type, double form of momentary contact, battery magneto circuits, single-pole and three-way lock switches. Lighting systems of more or less special character can be arranged by gang combinations made up of these various types.

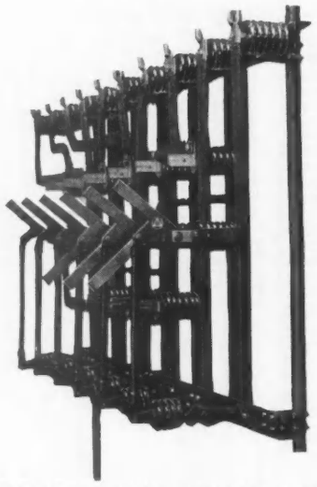
Small Wiring for Switchboards

Where a large amount of instrument and control wiring must be installed on the rear of a switchboard the arrangement of the wires becomes of considerable importance. The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., runs the wires up the webs of the vertical supports of switchboards mounted on its standard angle-iron frames.

With the improved arrangement by placing the wires with due regard to the apparatus to which they connect on the panel, it is possible to bring them out opposite the particular piece of apparatus and run them horizontally to it along the back of the panel itself. This means that all wires are accessible and that what would ordinarily mean a rear extremely crowded with instrument and control wiring or with a bulky group along each angle becomes a panel in which there is little crowded wiring. This workmanlike and accessible wiring, however, is only possible where an angle iron, such as the standard Westinghouse frame, is employed for supporting the switchboard.

Remote-Control Switch

The Booth-Hall electric furnaces are so arranged that the transformers are connected in series, giving full arc voltage when melting down. When holding



SWITCH IS USED FOR ELECTRIC FURNACE INSTALLATIONS

a heat or refining, the transformers are connected in parallel, giving one-half voltage but maintaining the full normal current. To make this change quickly in transformer connections, the Delta-Star Electric Company of Chicago has designed the manually operated remote-control six-pole switch shown in the accompanying illustration.

When melting down, the switch blades are thrown from the open position shown to the upper—all six blades making contact. For reducing the voltage the switch blades are thrown down, in which case only the three double-throw blades make contact. This development in switching equipment for electric furnace installations is of particular interest, as it enables better furnace operation, the manufacturers point out.

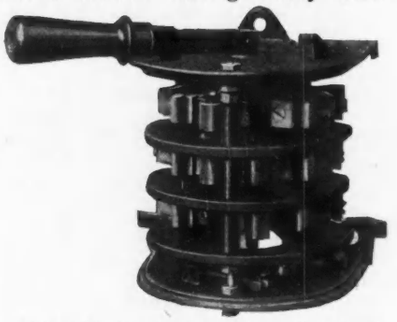
Drum Reverse Switch

One of the latest products of the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is a small drum reverse switch for operating motors in machine-tool, woodworking and other services requiring reversing of the motors. The small size and neat appearance of this reverse switch make it especially adapted for mounting directly on the machine.

A terminal board of heavy micarta forms the back of the switch, and on the front side of this board are mounted the stationary contacts. The movable contacts are mounted on cast-brass brackets clamped on the shaft, from which they are thoroughly insulated. Good contact is insured by phosphor-bronze springs on the movable contacts, these being protected by copper shunts. Heavy barriers of asbestos lumber separate adjacent sets of contacts so that cross-arcing is impossible, it is pointed out. All live parts are protected from exposure by an inclosing cover of sheet steel lined with asbestos and held in place by two ring latches, which permits its easy removal for renewal of contacts.

These switches are made for alternating-current or direct-current circuits. For alternating-current service and for direct-current service without dynamic braking they are provided with "forward," "off" and "reverse" positions. For alternating-current service the motor is connected directly across the line.

For direct-current applications with dynamic braking the switch handles have five positions as follows: "Forward," "drift," "off and brake," "drift," and "reverse." They may be used with automatic starters for shunt and compound-wound motors. With compound-wound motors having heavy series

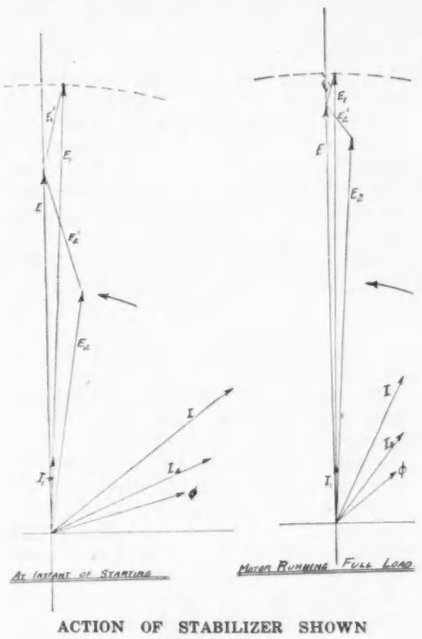


DRUM REVERSE SWITCH WITH COVER REMOVED

winding for tail-stock and cross-rail service they may be used to connect the motor directly to the line, either with or without resistors permanently connected in series with the armature.

Voltage Stabilizer

In electrical systems of distribution an instantaneous or sustained increase or decrease of current produces a corresponding voltage change, more or less pronounced, depending on the combined regulation of the line and transformer



ACTION OF STABILIZER SHOWN VECTORIALLY

I = line current. I_1 = lamp current.
I_2 = motor current (starting, running).
E = line volts, E_1 = lamp volts.
E'_1 = regulator lamp coil volts.
E'_2 = regulator motor coil volts.
E_2 = motor volts; Φ = regulation flux.

from which power is derived. If the system is a mixed one supplying a combination load of lamps and motors, then the changes of voltage produce serious results in the form of lamp flicker—even if the voltage varies by only 1 or 2 per cent.

An alternating-current stabilizer has been developed by the General Electric Company of Schenectady, N. Y., which eliminates these objectionable features and makes possible the operation of motors in places where the lighting service must not be impaired, it is said. The stabilizer is essentially a highly reactive transformer having a primary through which the motor current flows and a secondary which is connected in series with the lamp load and boosts by an amount proportional to the voltage drop caused while starting.

The stabilizer consists of a laminated core in which an adjustable air gap has been interposed. On the middle leg of the core structure are interwound the motor and lamp coils. When starting, the rush of current through the motor coil excites the magnetic circuit of the stabilizer and induces a voltage in the lamp coil which is substantially in phase with the lamp voltage. This action is shown in the vector diagram where E is the voltage added vectorially by the lamp coil in order to maintain E_1, the lamp voltage, at a constant value. If, however, a transformer or reactance is inserted permanently in series with the motor, its terminal voltage is excessively lowered, and this might be detrimental since in some cases full load could not be delivered. In the stabilizer this effect is overcome in two ways—first, by designing so that at normal full load running current the flux density in the iron core is low, which means a correspondingly low voltage drop; second, by inserting an air gap in the iron core, by which means the stabilizer is made highly reactive and most of the drop over the motor coil is in quadrature with the line voltage except for copper and core loss. These losses can and must be kept low in order to make the apparatus efficient. This is shown in the diagram, where E_2 is motor terminal voltage and E'_2 the voltage drop over the motor coil of the stabilizer.

The stabilizer may be applied to any power apparatus operating in combination with lighting loads. Thus it may be used for general industrial purposes for hotels and apartment houses and small isolated stations of limited capacity. The nature of the load influences the method of applying the stabilizer, especially where it is required to operate over a wide difference of starting power factors.

Electric Suction Cleaner

One of the latest models of electric suction cleaner made by the Kent Vacuum Cleaner Company, Rome, N. Y., is made in two separable parts, the upper section containing the dust can. The suction plant is mounted in the aluminum base and is driven by a Westinghouse universal motor. The equipment includes carpet nozzle, wall brush, hardwood floor pad, upholstery cleaning tool, 12 ft. (3.7 m.) of hose and 20 ft. (6.1 m.) of flexible cord.

Weatherproof Plug and Receptacle

The latest addition to the Ralco line of heavy-duty plugs and receptacles handled by the Central Electric Company of Chicago, Ill., is known as the No. 22, designed for use on three-phase alternating-current or three-wire direct-current circuits, the plug being non-reversible. This device is a three-pole weatherproof receptacle with fuse connection that has a capacity of 30 amp. on 250 volts. It is regularly furnished with a D. & W. inclosed fuse cut-out, No. 91,103, set in place and wired to the receptacle. It can also be furnished when specified with a plug fuse block.

The body is of cast iron, provided with a door at the top for ready access to the fuses when necessary, but the entire front is removable for wiring. Receptacles are protected by the spring door, which closes automatically as the plug is withdrawn. The hinged door for the fuse and the spring door to the receptacle are provided with gaskets.

Flux Paste

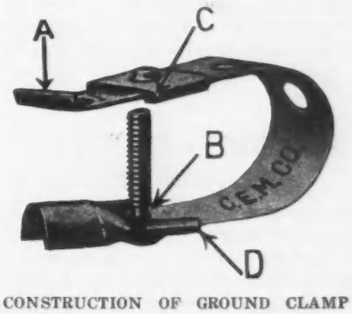
Flux paste which, it is claimed, does not eat or rust copper, brass, iron, steel or any other metal has been developed by Hess & Son of Philadelphia. This paste as it evaporates leaves behind it a thin coating of clean, bright tin to which the solder takes readily. It is said that this paste will instantly tin a new, clean iron. Attention is called to the fact that this paste will not injure the most delicate fabrics, such as the silk insulation on electric wires.

Direct-Current Ratio Relay

Two noteworthy features pointed out for the direct-current ratio relay made by the Western Electro-Mechanical Company of Oakland, Cal., are its size and its guaranteed accuracy. The manufacturers point out that the troubles usually encountered in the service calibration of high-rating direct-current meters are: (1) Difficulty of shunting meter out of service, (2) stray fields from shunt leads affecting meter under test or standards, (3) difficulty of calibrating high-rating standards, (4) large, cumbersome leads, shunts, etc., requiring considerable investment, time and caution if test is to be reliable. These difficulties, it is said, are largely overcome by use of the ratio relay. An iron core carrying a secondary winding, similar to the well-known current transformer, is slipped over the bus or feeder, and the current flowing through the winding on the iron core is metered by means of low-capacity standards. This relay is made in capacities ranging up to 10,000 amp.

Ground Clamps

An improved design of ground clamps has been produced by the Connecticut Electric Manufacturing Company of Bridgeport, Conn. Attention is called to the construction shown in the accompanying illustration whereby the nut and screw are attached to the clamp itself, thus eliminating the possibility of the workman reaching the job with some of these parts missing. The sliding band or nut screw with undercut thread are also features which



CONSTRUCTION OF GROUND CLAMP

make this device easy to install. Referring to the illustration, *A* is a stop for the sliding band *C*, *B* the undercut screw which cannot drop out, and *D* a reinforced band giving strength under the screw head.

Machine for Polishing, Sanding and Scrubbing Floors

The floor machine manufactured by the Kent Vacuum Cleaner Company, Inc., of Rome, N. Y., is provided with four interchangeable attachments, one for polishing waxed floors, one for

PROVIDED WITH FOUR INTERCHANGEABLE ATTACHMENTS

scrubbing floors of all types, one for removing varnish and one for sanding floors. These attachments are a steel wire brush, a palmetto scrubbing brush, a tampico polishing brush and a sandpaper disk. They are circular and are rotated continuously in one direction as the machine propels itself over the floor.

When the operator raises the handle slightly the machine moves to the right. Lowering the handle causes it to move to the left. Twisting the handle slightly in one direction causes the machine to move forward. Twisting it in the opposite direction causes it to move backward.

The machine is operated by a 1/6-hp., 1750-r.p.m. motor. The speed of the brush is reduced to 200 r.p.m. through a reduction gear drive. The motor is completely inclosed and the entire machine is provided with an aluminum case, thus obviating any danger of the revolving part striking and injuring furniture, baseboards, etc., and making it possible to operate the machine against baseboards and into corners. The motors used are a special design made for the Kent Vacuum Cleaner Company by the Robbins & Myers Company. They can be furnished for operation on 110 volts or 220 volts direct current or on alternating current of 110 volts or 220 volts at 25, 40 and 60 cycles.

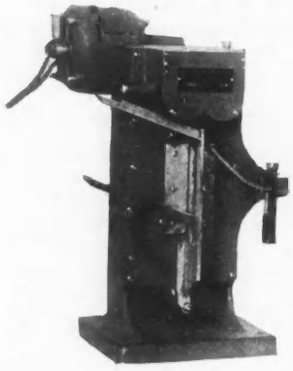
Portable Storage-Battery Spotlight

A design of searchlight adapted for projection that can be operated on a set of storage batteries is now made by the Penfield Manufacturing Company, 49 Randolph Avenue, Meriden, Conn. This searchlight is mounted on the top of a pipe support and has a hinged joint, so that a wide vertical swing is possible. A parabola reflector is provided which, it is claimed, will throw a strong light 900 ft. (274.3 m.). The construction of both the lamp and the battery box is waterproof so that the outfit can be used exposed to the weather. An "on" and "off" switch is provided in the body of the lamp. The storage battery furnished has a rating of 100 amp.-hr. and for ordinary use requires charging about once a week.

This company also makes a spotlight for bracket mounting, finished in black and polished nickel and provided with a rear-view mirror. This spotlight can be used for stationary use or on automobiles and trucks.

Motor-Operated Space-Band Cleaner

The List Manufacturing Company of Clare, Mich., has developed a machine to clean automatically space bands used with linotype machines. This machine also graphites the bands. Unless the bands are kept free, the work of the machine is imperfect and the linotype itself deteriorates. Since cleaning the space bands by hand tends to flatten them and leads to imperfect casting, the machine here illustrated was developed. It cleans and graphites fifty space bands per minute and is actu-



OPERATED BY A FRACTIONAL-HORSEPOWER MOTOR

ated by a fractional-horsepower motor manufactured by the General Electric Company. These motors are standard equipment and operate on the currents obtainable from an ordinary lamp socket.

Snubber for Guy Wires

The National Telephone Supply Company of Cleveland, Ohio, has developed a special device for use with a breaker in guy wires. This device consists of a one-piece malleable casting galvanized by the hot-dip process and made in three sizes for use with ¼-in. (6.4-mm.) strand guy wire, 5/16-in. to ⅜-in. (7.9-mm. to 9.5-mm.) strand guy wire and 7/16-in. to ½-in. (11.1-mm. to 12.7-mm.) strand guy wire. The features of this device are pointed out by the maker to be its simplicity, its ease of installation and its ruggedness. There are no bolts or other parts to rust, corrode or get loose, and no special tools are required for its installation. Further, it is pointed out that this snubber does not break the galvanizing on the strand and saves 3 ft. (0.91 m.) of guy wire.

Porcelain Current Taps

Porcelain current taps, manufactured by the Bryant Electric Company of Bridgeport, Conn., are virtually a ready-wired socket adapter with a slotted receptacle in the side for cap or plug. One end of the body is fitted with a standard screw plug, similar to a regular lamp base, while the other end is designed to receive a standard medium-base lamp. Thus a lamp may be removed from its socket, the tap put in its place and the lamp screwed into the outer end of the tap. The tap, therefore, not only provides for the retention of the lamp in its original location, but provides a suitable approved receptacle for attachment plug.

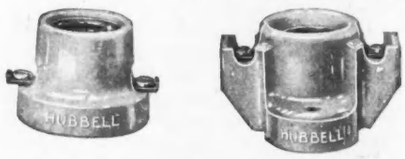
This device can be furnished for multiple connection or series connection.

Automobile Spotlight

An automobile electric spotlight produced by the Pittsburgh (Pa.) Electric Specialty Company is designed so that it may be equipped with locking clamps to comply with various city statutes. Many rulings have recently been passed forbidding the use of spotlights which throw any direct rays over a horizontal line 42 in. (106.7 cm.) from the ground. Used with the new clamp this spotlight complies with the regulations. This spotlight uses a triple reflector designed to concentrate all the rays into a beam of uniform intensity, eliminating glare. The lamp has an outside focusing adjustment and a 4-in. (10-cm.) adjustable vision diminishing mirror is provided. The standard finish is black japan.

Porcelain Receptacles

Three porcelain receptacles have just been placed on the market by Harvey Hubbell, Inc., of Bridgeport, Conn. Catalog No. 9171 is a cleat receptacle which is supported by one screw through the center of the device. Catalog No. 59,275 is another type of cleat receptacle made with lugs on each side to accommodate wiring raised 1 in. (2.54 cm.) from the surface. Catalog No. 61,988 is a receptacle for conduit box and metal-sign work. This receptacle is constructed with five notches in the base. Bending one projection from the metal plate into any one of the notches will guarantee a



LINE OF PORCELAIN RECEPTACLES

permanent location for the receptacle after its installation. Another feature pertaining to this device is the screw ring which will permit the removal of the shell without disturbing the wiring. All of these receptacles are rated at 660 watts and 250 volts.

Trade Notes

CHARLES W. MALCOLM, formerly sales manager for the Geyser Electric Company, Chicago, was recently appointed general manager.

THE WARD LEONARD ELECTRIC COMPANY of Mount Vernon, N. Y., is now represented in San Francisco, Cal., by the Electric Material Company, 589 Howard Street.

H. P. G. NOSTAND, for thirteen years general superintendent and later vice-president and general manager of the Rathbone-Sard Electric Company, Albany, N. Y., has resigned.

FRANK O. WALLENE of the Electric Machinery Company, Minneapolis, Minn., has been transferred from the factory to Cleveland, Ohio, where he is opening an office as district manager.

W. H. JEFFERSON is now stationed in the New York City office of the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. Mr. Jefferson will handle Thomas meter sales for the company in the East.

THE HARTFORD MACHINE SCREW COMPANY, Hartford, Conn., has made large additions to the extensive plant of its main works, which have recently been completed and now comprise over 200,000 sq. ft. of floor space.

THE CIRCUIT is the title of a new house publication from the Elliott-Lewis Electrical Company, Inc., Philadelphia, the first number making its appearance for October. The letterpress, illustrations, etc., are pertinent and well selected.

THE WAGNER ELECTRIC MANUFACTURING COMPANY of St. Louis announces the opening on Nov. 15 of a sales office at 116 Auburn Avenue, Atlanta, Ga., in charge of Charles M. Welch, formerly branch office manager at Indianapolis, Ind.

THE SMITH-SERRELL COMPANY, INC., New York City, is giving preference to all orders for its product which either directly or indirectly help in the production of munitions and other necessary war supplies. Orders must be so classified, giving destination and how used.

THE WESTBURG ENGINEERING COMPANY, Chicago, which handles the line of the Ward Leonard Electric Company, Mount Vernon, N. Y., is the new corporate name of what was formerly the Badt-Westburg Electric Company. This involves no change in management.

THE NAGLE CORLISS ENGINE WORKS, Erie, Pa., have opened an office at 39 and 41 Cortlandt Street, New York City. Frank W. Richardson is in charge. This gives the company direct representation and insures immediate personal attention to all inquiries as to prices and delivery promises.

THE GENERAL ELECTRIC COMPANY'S repair shop at Atlanta, Ga., is fully equipped to give repair service on all classes of direct-current and alternating-current apparatus. Correspondence in regard to work of this kind should be addressed to the Engineering Department, Third National Bank Building, Atlanta Ga.

GEORGE H. MORRIS, who was formerly assisting operating and construction engineer for the Electric Storage Battery Company at Chicago, has resigned to become president and treasurer of the Morris Battery Service Company of Evanston, Ill. Mr. Morris has been engaged in manufacturing, construction and maintenance of storage batteries for eighteen years.

THE CRANE COMPANY'S new exhibit rooms at 23 West Forty-fourth Street, running through to Forty-fifth Street, New York City, "symbolize the character of the goods for which they furnish an architectural setting," to use the words of Frederick Stanley, manager of the Chicago company's branch house. A complete sample line of products is arranged and displayed in a striking manner, each exhibit having a plate giving the name of the piece, catalog number and sizes in which it is made.

W. J. DRURY, sales manager for five years at Dallas, Tex., has been promoted to the managership at Cleveland, Ohio, of the Western Electric Company, Inc., New York City. Mr. Drury has been in the service of the company since 1904, when he graduated from Purdue University as an electrical engineer. Henry P. Hess, who has been in charge of sales at Houston, Tex., goes to Dallas in Mr. Drury's place. George L. Chestnut, formerly in the sales department at St. Louis, Mo., later at Dallas, succeeds Mr. Hess at Houston.

H. N. GOODELL, who was the manager of the Western Electric Company's Omaha (Neb.) house since 1912, has been made assistant central district manager, with the Minneapolis organization reporting to him hereafter. Mr. Goodell, who will continue his work as manager at Omaha, where he will reside, has been with the company for eleven years in various positions in the West and East. Alfred H. Bannister, who becomes sales manager at Minneapolis, has been on the Western Electric Company's staff for eleven years, first entering the service at New York, later going to Minneapolis and Omaha.

Trade Publications

SOCKETS.—Harvey Hubbell, Inc., of Bridgeport, Conn., has prepared a leaflet descriptive of its quick-catch sockets.

INSULATORS.—The Locke Insulator Manufacturing Company of Victor, N. Y., has prepared supplement No. 2 to its insulator book.

MOTORS.—Phoenix induction motors, two-phase and three-phase, are described in a booklet prepared by the Phoenix Electric Company of Mansfield, Ohio.

ELECTRICAL APPARATUS.—The General Electric Company of Schenectady, N. Y., has issued two indexes, one to supply-part bulletins and the other to descriptive bulletins and sheets.

WOMEN'S WORK IN WAR TIME.—The Merchants' National Bank of Boston, Mass., has published a book entitled "Women's Work in War Time," by W. Irving Bullard, manager of the textile department.

HARDNESS TESTING MACHINE.—A useful bulletin has been prepared by the Scientific Materials Company, 711 Forbes Street, Pittsburgh, Pa., descriptive of an improved American model Brinell hardness testing machine with special depth-measuring gage.

METERS AND CIRCUIT BREAKERS.—The General Electric Company of Schenectady, N. Y., has prepared bulletin No. 46,201A, descriptive of its single-phase watt-hour meters, types I-14, IS-4 and IS-5. This company has also prepared bulletin No. 47,469, descriptive of its type FK-24 oil circuit breakers.

MAGNETIC GEAR SHIFT.—The Cutler-Hammer Manufacturing Company of Milwaukee has just published a 100-page booklet containing reproductions of letters received from motorists giving opinions on the C-H magnetic shift. The letters are photographically reproduced and are interesting in that they indicate a well-defined liking by the motor-car driver for pre-selection of speeds as provided by the magnetic shift.

SPEED MOTORS.—The General Electric Company, Schenectady, N. Y., in bulletin No. 41,021, describes the R. F. line of adjustable-speed motors, which are the results of many years of experience and numerous tests under actual shop operation. Among the advantages of this R.F. type motor is the practical elimination of commutation troubles arising from abuse or careless operation. Special attention has been given to efficiency regulation, stability and insulation.

DRYING APPARATUS.—The J. P. Devine Company has just published bulletin No. 104, covering its patented vacuum drying and impregnating apparatus. This bulletin gives detailed information of the equipment referred to, which is used very extensively for the impregnation of armature, field, magnet and transformer coils, power and telephone cables, insulator pins and electrical work of any nature. The bulletin describes the operation of the apparatus, giving data as to its exact use in the electrical field and comparing the old method of impregnating by the baking oven with this process of vacuum and pressure impregnation. The publication is profusely illustrated with pictures covering installations that this company has made in this field.

WATER-TUBE BOILERS.—The Bigelow Company of New Haven, Conn., has prepared a cloth-bound book descriptive of its Bigelow-Hornsby water-tube boiler. This book describes several notable foreign installations, size of units and flexibility of construction, feed and circulation, sustained economy, the large percentage of direct heating surface, baffling and smoke-flue connection, free liberation of steam, superheating, accessibility and other important features. A list of some installations of these water-tube boilers is given, as are illustrations of installations in various well-known power plants. In the back of the book are given a saturated-steam-pressure table, a superheated-steam table and other useful tables. This book is well illustrated and shows great care in its make-up.

FIXTURES.—"Lightoliers" for correct illumination and interior decoration of modern homes are illustrated and described in a book prepared by the New York Gas & Electric Appliance Company, 569 Broadway, New York City. This book is very attractive in its make-up and illustrations and gives complete information regarding the line of fixtures made by this company. It should be in the hands of every dealer in electrical fixtures. By referring to the illustrations any one can readily select designs in harmony with furniture and hardware, as well as shades and globes blending pleasantly with wall tints, rugs and draperies. This book is really a lighting-fixture display room in printed form, which faithfully represents the merchandise offered, showing at a glance where each design may be used effectively. On the introductory page to each distinctive group of "Lightoliers" representative designs from that group are illustrated as they would appear actually installed amid home surroundings.

New Incorporations

THE CHALLENGE SPARK PLUG COMPANY of Joliet, Ill., has been incorporated by William Heggie, C. L. E. Miller and C. McNaughton. The company is capitalized at $20,000.

CHARLES A. JACKSON, INC., of Boston, Mass., has filed articles of incorporation with a capital stock of $10,000 to manufacture electrical appliances and machinery. Charles A. Jackson of Newton, Mass., is treasurer.

THE VECCHIO MANUFACTURING COMPANY of Albany, N. Y., has been chartered by L. Vecchio, J. A. Pabula and F. Mondello. The company is capitalized at $10,000 and proposes to manufacture electrical machinery.

THE BARIO METAL CORPORATION of New York, N. Y., has been chartered with a capital stock of $90,000 to manufacture electrical furnaces. The incorporators are: N. Herbschleb, P. Demiles and H. Jenkins, 31 Park Row, New York City.

THE PEERLESS WATCHMEN'S CLOCK COMPANY of New York, N. Y., has been chartered with a capital stock of $75,000 to manufacture special clocks. The incorporators are: H. T. Stetson and R. L. Kritzler, 1081 Union Avenue, New York City.

THE STEELE MANUFACTURING COMPANY of Indianapolis, Ind., has been chartered with a capital stock of $50,000 to manufacture machinery and electrical devices for automobiles. The incorporators are: B. Steele, Gottfried D. Yeager and Frank Fertig.

THE STANDARD ELECTRIC & ELEVATOR COMPANY of Baltimore, Md., has been incorporated with a capital stock of $500,000 by Frank Stark, Cyrus A. Yarrington and Carroll B. Roberts. The office of the company is located at 118 West Pratt Street, Baltimore.

THE HEATING SPECIALTY COMPANY of Toronto, Ont., has been incorporated with a capital stock of $50,000 by James Parrish, William A. Ross, Harry W. Page, 12 Richmond Street, East, and others. The company proposes to manufacture stoves, grates, furnaces, boilers and gas and electric heaters, etc.

THE DIRIGIBLE AUTO LIGHT COMPANY of St. Joseph, Mo., has been chartered with a capital stock of $25,000 by Dr. U. G. Crandell, Dr. E. H. Bullock and John P. Strong. The company proposes to manufacture devices for focusing, adjusting and turning headlights on automobiles, locomotives, interurban cars, etc.

THE LAKEWOOD-GALION COMPANY of Galion, Ohio, has been incorporated by interests associated with the Lakewood Engineering Company of Cleveland. The plant of the Galion Dynamic Motor Truck Company was recently acquired by the Lakewood Engineering Company, and in it it will manufacture electric trucks and tractors, storage batteries and trolley locomotives. The capital stock of the Lakewood-Galion Company is placed at $100,000. The general offices will be located in Cleveland in connection with the Lakewood Engineering Company.

New England States

OAKLAND, ME.—Plans have been filed by the American Woolen Company, Shawmut National Bank Building, Boston, Mass., for the construction of a new power house, to cost about $75,000, at its local plant. The E. W. Pitman Company, Bay State Building, Lawrence, is contractor.

MONTPELIER, VT. — The Vermont & Quebec Power Company of Richford has purchased the Fessenden power about 3 miles south of Brome Lake in Canada. The company, it is reported, expects to erect a transmission line this fall and connect this power with that used at Stevens Mills for operating the talc works at Johnson. It is expected that 2000 hp. for 24 hours can be developed at the new site. Charles H. Thompson of Montpelier is manager.

GARDNER, MASS.—Plans have been prepared by the Central Oil & Stove Company, 205 School Street, for the construction of a transformer house and pumping station at its plant. Roger E. Coolidge, 34 Chapin Street, Southbridge, is architect.

SEEKONK, MASS.—The Massachusetts Gas and Electric Light Commissioners have granted the Seekonk Electric Company permission to erect and operate an electric transmission line between Seekonk and Attleboro, where connection will be made with the plant of the Attleboro Steam & Electric Company. By means of this line the Attleboro company will be able to secure energy from the large generating station of the Narragansett Lighting Company situated on tidewater and from the transmission system of the New England Power Company.

SPRINGFIELD, MASS. — Contract has been awarded by the War Department to Fred T. Ley & Company of Springfield for extensive additions and extensions at the Hill and Watershop plants. For the Ordnance Department the contract calls for the construction of a power house at the Hill plant, including turbines, generators, condensers, motors, etc., a rest room and lavatory and barracks for 150 men; for the Quartermaster's Department at the Hill plant, two barracks, one large lavatory, one officers' quarters, one guard house, one storehouse, one recreation building, hospital and heating plant; at the Watershop plant, one barracks, one lavatory, one guardhouse, one officers' quarters and heating plant will be erected. The contract amounts to about $200,000.

WEST SPRINGFIELD, MASS.—The Boston & Albany Railroad Company has abandoned its plans for the construction of a 200,000-kw. power house at West Springfield. The company has now decided to erect a transformer station, at a cost of about $35,000, and secure electricity from the Turners Falls Power Company.

PAWTUCKET, R. I.—Steps have been taken by the Chamber of Commerce to secure better lighting facilities for the business section of the city.

BRIDGEPORT, CONN.—Plans have been filed by the Fairbanks Storage Battery Company, 438 Atlantic Street, Stamford, for the construction of a new storage battery station, 40 ft. by 120 ft., at Bridgeport, to cost about $20,000. Contract has been awarded to W. A. Smith & Son, 188 Cannon Street, Bridgeport.

Middle Atlantic States

BATAVIA, N. Y.—The Genesee Light & Power Company has submitted a proposal to the City Council for furnishing Niagara power for lighting the streets of the city and for operating the sewage disposal machinery.

BUFFALO, N. Y.—Contract has been awarded by the Erie Railroad Company for extensions and repairs to its East Buffalo shop, which will include the installation of a Robbins coal-handling plant.

BUFFALO, N. Y.—Plans have been filed by the Fore River Shipbuilding Corporation of Quincy, Mass., for the construction of a one-story machine shop at the site of its new turbine plant on Vulcan Street, Buffalo.

BUFFALO, N. Y.—Plans have been prepared by the Ferguson Steel & Iron Company, 1399 Bailey Street, Buffalo, for the construction of a new power house, 30 ft. by 130 ft., at the plant of Farrar & Trefts, 67 Perry Street.

HOOSICK FALLS, N. Y.—The Village Trustees have entered into a new contract with the Twin State Gas & Electric Company for lighting the streets of the village for a period of five years, under the terms of which the company will install a new type of lamp. The new system provides for 29 lamps of 250 cp. and not less than 143 of 80 cp.

JOHNSTOWN, N. Y.—The Glen Telephone Company has filed notice of an increase in capital stock from $300,000 to $400,000, the proceeds to be used for expansion of system.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NIAGARA FALLS, N. Y.—Plans have been filed by Hydrofats, Inc., 98 Delaware Avenue, for the construction of a new power house, in connection with another shop building, the entire work to cost about $20,000. Contract has been awarded to John W. Cowper, Fidelity Building, Buffalo.

ROCHESTER, N. Y.—Contract has been awarded by the Rochester Light & Power Company to the Turner Construction Company, 244 Madison Avenue, New York, N. Y., for the construction of a four-story addition, 35 ft. by 50 ft., to its power plant.

SEWARD, N. Y.—The Seward Electric Lighting & Power Company has petitioned the Public Service Commission for permission to issue $44,000 in capital stock, the proceeds to be used to pay for extensions.

SKANEATELES, N. Y.—The Skaneateles Paper Company is building a new power house at its Draycott mills.

ATLANTIC CITY, N. J.—Bids are being received by proprietors of Haddon Hall Hotel for the construction of a power house, 25 ft. by 80 ft. Addison H. Savery of Atlantic City is architect.

DOVER, N. J.—Work has begun on the erection of a large addition to the plant of the New Jersey Power & Light Company. Orders have been placed for new equipment, including a 3500-kw. turbine, equipped with a Westinghouse condenser and two Babcock & Wilcox boilers, equipped with Westinghouse stokers.

JERSEY CITY, N. J.—The American Sugar Refining Company, 153 Washington Street, is contemplating alterations and improvements to its power house, for which a permit has been taken out.

JERSEY CITY, N. J.—Permission has beeen granted the Great Atlantic & Pacific Tea Company to lay conduits in Provost Street, to connect with nearby buildings, which will be supplied with electricity by the company. The conduits will be short lines in Provost and First Streets.

TRENTON, N. J.—The American Telephone & Telegraph Company is planning to install underground conduits in various streets in the city to replace its overhead wires.

CHALFONT, PA.—The Borough Council has entered into a contract with borough of Lansdale to supply energy in Chalfont for a period of 15 years.

PHILADELPHIA, PA.—Plans are being prepared and permit taken out by Francis Thole, Fifty-eighth and Hoffman Avenue, for an addition to power house at his plant.

PHILADELPHIA, PA.—The Commercial Engineering Company, 1527 Sansom Street, has been awarded contract for the installation of a new electric system at the local navy yard, to cost about $25,000.

PHILADELPHIA, PA. — Contract has been awarded by the city of Philadelphia to the Standard Construction Company, 1713 Sansom Street, for the construction of a new power house at Vintage and University Avenues, at about $238,000.

PHILADELPHIA, PA. — Considerable locomotive shop equipment and cranes will be required for the large erecting shop now under construction by the Baldwin Locomotive Works. The cost of the cranes is estimated at $500,000 and will include four 100-ton, two 50-ton trolleys; four 150-ton, two 75-ton trolleys; two 70-ton, two 35-ton trolleys; two 50-ton, two 25-ton trolleys; eight 20-ton, 10-ton trolleys; all are to be of 74 ft., 8 in. span.

PHOENIXVILLE, PA.—Plans have been prepared for an addition, about 26 ft. by 55 ft., to the pumping station of the Springfield Water Company.

STROUDSBURG, PA.—Bonds to the amount of $84,000 and $100,000 in capital stock have been issued by the Stroudsburg Traction Company, the proceeds to be used for extensions and improvements.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company has begun work on the erection of a high-tension electric transmission line from Waynesboro to Smithsburg, Md. This line will connect Waynesboro with Hagerstown and Security, Md.

YORK, PA.—An ordinance authorizing a contract with the Edison Electric Light & Power Company for lighting Center Square for a period of five years has passed its first reading in the City Council. The contract provides for the erection of 12 ornamental standards, mounted with nitrogen lamps of 100 cp.

BALTIMORE, MD.—Plans are being prepared by Cockran, Hill & Company, 221 South Howard Street, for an addition (three stories) to its power station at Sixth Street and Wilkens Avenue.

BALTIMORE, MD.—Contract has been awarded by the Baltimore Dry Docks & Shipbuilding Company for the construction of a power house, 57 ft. by 69 ft., to the West Construction Company of Baltimore.

BALTIMORE, MD.—Contract has been awarded by the Bartlett-Hayward Company, Scott and Henry Streets, to the Morrow Brothers, Fidelity Building, for the construction of a new power house, 44 ft. by 46 ft., at its plant.

SINGERLY (P. O. ELKTON), MD.—Contract has been awarded by T. W. Bacchus to A. M. Stricklin & Son, Elkton, for the construction of a new one-story power house.

MORGANTOWN, W. VA.—The West Virginia Traction & Electric Company is installing new stoker equipment in its local power plant, and will also install a new Westinghouse 1250-kw. turbine.

GLENLYN, VA.—Plans and specifications have been completed by Viele, Blackwell & Buck, consulting engineers, 49 Wall Street, New York, N. Y., for the construction of a steam-driven electric generating plant on the New River for the Appalachian Power Company of Bluefield. The plans provide for an ultimate capacity of 60,000 kw., with an initial installation of 20,000 kw. The steam plant will supplement the Appalachian hydroelectric plants already built on the New River in transmitting energy to the Pocahontas coal field and other power consumers in southwestern Virginia and southern West Virginia.

NEWPORT NEWS, VA.—The Newport News Shipbuilding & Dry Dock Company is reported to be in the market for a large number of electric hoists for new destroyer shops, and other equipment.

RICHMOND, VA.—Plans have been filed by the Richmond Terminal Company for the erection of a new signal tower, 20 ft. by 30 ft., three stories high. Contract has been awarded to the John T. Wilson Company, Mutual Building, Richmond.

WASHINGTON, D. C.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, for the installation of a refrigerating plant at the Naval Hospital, to cost about $63,000.

WASHINGTON, D. C.—Plans have been prepared by Milburn, Heister & Company, Union Savings Bank Building, Washington, for the construction of an addition to the plant of the Potomac Electric Power Company, to cost about $27,000.

WASHINGTON, D. C. — The United States government will establish three large terminal stations on the Atlantic seaboard, one near Norfolk, Va., one near Baltimore, Md., and the third on the Raritan River, New Jersey, at a cost of about $18,000,000. A large number of locomotives will be required.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 10 for the installation of an electric elevator in the gun shop in Washington, D. C. Drawings and specifications (No. 2695) may be obtained on application to the above bureau or the commandant of the navy yard named.

North Central States

DETROIT, MICH.—The Public Lighting Commission has awarded the contract for additions and alterations in the substation of the municipal electric-lighting system on Lawton Avenue, between West Warren and West Hancock Avenues, to Corrick Brothers.

BOLIVAR, OHIO.—Work has begun on the erection of a large electric-generating plant at Bolivar by the Doherty Organization, 60 Wall Street, New York, N. Y. The plant when completed will supply electricity in Alliance, Massillon, Orrville and other cities in this part of the state. The initial installation calls for an expenditure of about $2,225,000. It is expected to have the plant completed by July, 1918.

CHARDON, OHIO. — The Council has voted to call an election to submit to the voters the proposal to issue $25,000 in bonds for the construction of a new electric-light plant.

CINCINNATI, OHIO.—The Union Gas & Electric Company is planning to convert its Canal Street power station into a dis-

tributing plant when its new river power plant is completed. Connections are being made between the Canal Street plant and the new plant for that purpose.

CLEVELAND, OHIO. — The Parish & Bingham Company is planning the construction of a one-story steel structure, 50 ft. by 265 ft., for storage purposes, and a two-story building, 50 ft. by 200 ft., for which contract has been awarded to the W. I. Thompson & Sons Company of Cleveland. The one-story building will be equipped with a 5-ton electrically operated traveling crane.

DAYTON, OHIO.—Electric lamps will be installed on Hillcrest Avenue, between Main Street and Riverside Drive, and on Todd Street, near Linden Avenue, as soon as the necessary funds are available.

MIDVALE, OHIO.—Plans have been prepared by the Northern Ohio Traction & Light Company of Akron for the construction of a power house, 25 ft. by 25 ft., in Midvale. F. C. Warner, Hippodrome Annex, Cleveland, is architect.

TOLEDO, OHIO.—Plans are under consideration for improvements to the street-lighting system in this city.

LOUISVILLE, KY.—The Louisville Gas & Electric Company, it is reported, contemplates the construction of a transformer station, 50 ft. by 200 ft.

RICHMOND, IND.—The installation of ornamental lamps on North E Street and on North Eighth Street, near the Union Station, has been recommended by the public improvement committee.

CHAMPAIGN, ILL. — The Urbana & Champaign Railway, Gas & Electric Company has petitioned the Illinois Public Utilities Commission for authority to issue $32,000 in capital stock.

CHICAGO, ILL.—The Hotpoint Electric Heating Company, Ogden Avenue and Twenty-second Street, Chicago, Ill., it is reported, is considering the construction of a factory, to cost about $250,000.

CHICAGO, ILL.—Plans have been completed by the Chicago Shipbuilding Company, a subsidiary of the American Shipbuilding Company, for an electric power plant at its South Chicago shipyards, located at 101st and Calumet River, to cost about $15,000.

DANVILLE, ILL.—The Danville Street Railway & Light Company has filed application with the Illinois Public Utilities Commission for permission to issue $49,000 in capital stock.

DECATUR, ILL.—The Decatur Railway & Light Company has petitioned the Illinois Public Utilities Commission for authority to issue $180,000 in capital stock.

URBANA, ILL. — Application has been filed with the Illinois Public Utilities Commission by the Urbana Light, Heat & Power Company for permission to issue $35,000.

WAUKEGAN, ILL.—Improvements are contemplated by the Public Service Company of Northern Illinois, 72 West Adams Street, Chicago, Ill., which will treble the output of its local plant.

DENMARK, WIS. — Preparations are being made by the Denmark Condensed Milk Company for the construction of a new power plant, 40 ft. by 60 ft. Bids, it is understood, will soon be asked for.

GREEN BAY, WIS.—The installation of an ornamental lighting system in the business districts in the east and west sides is under consideration by the Green Bay Association of Commerce.

MANITOWOC, WIS. — The Wisconsin Public Service Company of Green Bay has been granted a franchise to operate in Manitowoc.

MARATHON, WIS.—The Wisconsin Valley Electric Company of Wausau has been granted a franchise for the erection of an electric-light plant in Marathon.

MINNEAPOLIS, MINN.—The Northern States Power Company (the Minneapolis division) has accepted a contract from the Minneapolis Steel & Machinery Company amounting to 6500 hp., during the continuance of the war. The steel company is operating a large portion of its plant on a 24-hour basis.

CONWAY, IOWA.—An ordinance granting a 25-year franchise for the installation of an electric-lighting system in Conway has been passed by the Council. At a special election to be held Dec. 3 the proposal to grant the franchise to A. A. McKay will be submitted to the voters.

JOPLIN, MO.—The Empire District Electric Company is planning to increase its electric generating capacity by 55,000 kw., at a cost of about $75,000. Machinery, it is understood, has been purchased.

KANSAS CITY, MO.—Plans are being considered by the Fire and Water Board for the construction of an additional pumping station to cost about $500,000.

ST. JOSEPH, MO.—The City Council has rejected the latest proposal of the St. Joseph Railway, Light, Heat & Power Company for lighting the streets of the city.

GARRISON, N. D.—The installation of an electric-lighting plant in Garrison is under consideration.

HARTINGTON, NEB. — The Nebraska Electric Company of Crawford has been awarded a contract to install an electric-lighting system in Hartington.

ATCHISON, KAN.—The Blair Milling Company has leased a tract of land south of the Union Station, on which it will erect an electric generating plant to supply energy to operate the Blair wheat and corn product mills. The proposed plant will have a generating capacity of 1200 hp. and will also furnish electricity for the Blair elevator, located at the corner of Tenth and Main Streets.

EL DORADO, KAN.—Plans are being considered to install ornamental lamps on North Main Street, north of Sixth Avenue.

IRVING, KAN.—The City Council has passed an ordinance authorizing the city of Irving to enter into a contract with the Marshall County Power & Light Company of Blue Rapids to supply electricity here.

Southern States

BURLINGTON, N. C. — The Alamance Railway Company, recently incorporated with a capital stock of $60,000, proposes to construct and operate electric, steam or other railways in Alamance, Guilford, Orange, Durham and other adjacent counties and to connect Burlington, Graham, Haw River, Hopedale, Carolina and Glencoe. Its charter gives it the privilege of operating street railways. George W. Hatch of Burlington and J. Bridgers of Henderson, N. C., are among the incorporators.

AUGUSTA, GA. — Contract has been awarded by the fire-alarm and police telegraph committee to the Evans Brothers Construction Company of Augusta for the construction of a fire-alarm and telegraph station, at $10,387.

NEW PORT RICHEY, FLA.—The local electric-light plant has been acquired by the Richey Construction Corporation, which proposes to enlarge the plant and supply electricity for lighting the central part of the city. Later the company contemplates the installation of an alternating-current, 2200-volt, three-phase system. The company will also take over the present waterworks system and extend same and build an ice factory. Clyde F. Burns is general manager.

OLDSMAR, FLA.—The construction of an electric-light plant, ice factory and laundry in Oldsmar is under consideration. J. Bornstein is reported interested in the project.

PENSACOLA, FLA. — Improvements involving an expenditure of $75,000 have been authorized by the Pensacola Electric Company, which include removing the tracks of the Bayshore line farther from the beach. It is proposed to start at about Palmetto Beach and build a new car line around behind the settlement at Big Bayou.

RIDGELY, TENN.—The Domestic Ridgely Light & Ice Company, recently incorporated with a capital stock of $10,000, proposes to construct and operate an electric-light plant and ice factory. J. S. Riley, J. T. Foster and others are interested in the company.

BIRMINGHAM, ALA.—The Alabama Interurban Development Corporation, Jefferson County Bank Building, Birmingham, contemplates the construction of a railroad from Bessemer and Birmingham to the Warrior River, a distance of about 28 miles. The company is also considering the construction of a system of interurban railways throughout Alabama, with both north and south and east and west trunk lines and branches to county seats as far as possible. Thomas L. Cannon is president.

NATCHEZ, MISS. — Steps have been taken by local business men for the installation of an ornamental lighting system in the business district.

CAMDEN, ARK.—The boiler room of the local plant of the Arkansas Light & Power Company was destroyed by fire recently. The company, it is understood, will rebuild at once.

AFTON, OKLA. — The Public Service Corporation is contemplating building a 2000-ton ice storage house and installing a refrigerating plant. W. M. Glass is local manager.

BLACKWELL, OKLA.—The Modern Refining Company, recently incorporated with a capital stock of $250,000, is planning to equip a pipe line and install a 1200-bbl. pumping station. J. W. Squires of Blackwell is engineer.

CANADIAN, TEX. — Improvements are contemplated by the Canadian Water, Light & Power Company, including the installation of a new engine and other equipment.

DALLAS, TEX.—Plans are being prepared by the Dallas Power & Light Company for improvements to the local system, involving an expenditure of approximately $2,500,000 within the next five years. Additional machinery will be installed in the power plant and extensions made to the street railway system.

SAN MARCOS, TEX.—The San Marcos Utilities Company is contemplating improvements to its electric-light plant and water works system, to cost about $20,000.

UVALDE, TEX.—The Uvalde Electric Light Company is planning to enlarge its plant to supply power for pumping water from shallow wells for irrigation purposes.

VICTORIA, TEX.—Work will soon begin on the construction of the new municipal electric-light plant, to cost about $40,000.

Pacific and Mountain States

PROSSER, WASH.—The City Council is considering the installation of a new street-lighting system, in connection with making a new contract for lighting the city.

SHELTON, WASH.—The Puget Sound Pulp & Paper Company, which proposes to construct a large paper mill near Port Angeles, has applied to the Mason County Commissioners for a 50-year franchise to erect and operate an electric transmission line.

SPOKANE, WASH.—The control of the Spokane Heat, Light & Power Company has been taken over by a Cincinnati (Ohio) syndicate. Ludwig Kemper has been re-elected president and manager. Messrs. Field & Richards of Cincinnati, who floated the concern, have purchased a large portion of the local holdings.

VANCOUVER, WASH.—The Northwestern Electric Company has been granted a 50-year franchise by the Commissioners of Clarke County to erect electric transmission lines in the county around Camas and Washougal, and farther up the Columbia River.

ASTORIA, ORE.—The Pacific Power & Light Company of Portland has applied to the City Council for permission to erect a small substation on Taylor Avenue at the intersection of the port thoroughfare. The station will supply energy to the port terminals, shipyards in that vicinity and to other industries located along the port terminals.

BAKER, ORE.—The Fremont Power Company is installing an electrical system at the Buffalo Mines, near Baker.

HELIX, ORE.—The Portland Power & Light Company of Portland has been granted a five-year franchise to supply electricity for lamps and motors in Helix. The system will be installed as soon as supplies can be assembled.

WENDLING, ORE.—The Booth-Kelly Lumber Company of Springfield is planning to rebuild its local plant immediately. The saw mill and planing mill will be equipped for electrical operation throughout. An electric generating plant will be installed, which will have sufficient output to operate both mills and also to operate electrical cranes and other handling devices.

ALAMEDA, CAL.—The Board of Electricity has awarded a contract to Powell Brothers Construction Company for the construction of a new garage, at $3,562. The present garage will be used as a machine shop.

ALAMEDA, CAL.—The Great Western Power Company, 14 Sansome Street, San Francisco, has submitted a new proposal to sell energy in large quantity to the city of Alameda. The municipal electric plant is not able to meet the increasing demand for electrical service.

HANFORD, CAL.—The People's Ditch Company is considering the installation of an electric-light and power plant at the headgate of its irrigation system.

LOS ANGELES, CAL.—The Council has adopted the report of the finance committee recommending that the city attorney, city engineer and city electrician prepare an ordinance for the installation of an ornamental lighting system in the Van Nuys district.

ALBION, IDAHO.—A. M. Ohl of Albion has been awarded a contract by the United States Reclamation Department for the erection of about 9 miles of electric transmission lines in connection with the Minnidoka irrigation project in Idaho, at $6,245. The transmission line will supply electricity generated at the Minnidoka power plant to the Melcher Mining & Milling Company at Albion.

BRIGHAM CITY, UTAH.—The Reclamation Power Company has filed an application with the State engineer for 28 sec. ft. of water in Boxelder Creek, to be used for generating electricity.

EAST HELENA, MONT.—The Forestry Department has granted Jacobs & Flattow of East Helena permission to divert water from the McClellan Creek to develop power to be used in mine development work.

ELY, NEV.—Plans are being considered for the construction of a large hydroelectric development to supply electricity to the large copper mines in Ely. The installation will provide for an output of 4800 hp. and will cost about $1,200,000. The company expects to develop 10,000 hp. in three years. F. B. Ench of Oakland, Cal., is interested.

TEXICO, N. M.—The State Line Utilities Company has been granted a franchise by the Board of County Commissioners to erect a high-tension transmission line from its power plant, which is to be located at Texico, along the road connecting Texico and Clovis and south to Portales.

Miscellaneous

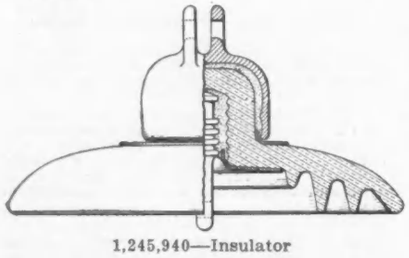
PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 7 for furnishing elevators, rolling mill scale, electric motors, shop machines, etc. Blanks and information relating to this circular (No. 1186) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York; Audubon Building, New Orleans, and Fort Mason, San Francisco.

Record of Electrical Patents

Notes on United States Patents issued on November 13, 1917

1,245,038. Protective Means for Electrical Distribution Systems; David Basch, Schenectady, N. Y. App. filed Nov. 13, 1916. Applies more particularly to systems in which insulated cables are employed as transmission conductors.

1,246,042. Flashlight; Bernard Benedict, New York, N. Y. App. filed Nov. 19, 1915. Pocket.



1,245,940—Insulator

1,246,054. Inclosed-Arc Device; John H. Clough, Schenectady, N. Y. App. filed Oct. 30, 1915. Relates to inclosed arc devices having a cathode consisting of high refractory material operating at incandescence in a gaseous atmosphere.

1,246,083. Electroplating; Harvey N. Gilbert, Brookline, Mass. App. filed April 24, 1915. Has for its primary object to reduce the time and cost of the plating operation to a minimum and to insure against any waste of the plating material.

1,246,088. Overflow Release Means; Charles L. Goodrum, New York, N. Y. App. filed April 27, 1916. Relates to circuit arrangements for overflow release of line finder and selector switches.

1,246,099. Process for the Extraction of Chlorine; Paul L. Hulin, Grenoble, France. App. filed Sept. 15, 1916. Has for its principal object to enable the more or less dilute chlorine contained in certain gaseous industrial mixtures to be extracted in a sufficient state of purity to permit it to be liquefied.

1,246,102. Junction-Box Connector; Max Janofsky, Washington, D. C. App. filed July 24, 1915. Provides junction box connector of simple construction, insuring a secure fastening and perfect bond between the cable sheath and junction box.

1,246.105. Refillable Cartridge Fuse; Oscar H. Jung, Milwaukee, Wis. App. filed March 8, 1917. Improvements.

1,246,106. Electric Welding System; Alvin D. Keene, Schenectady, N. Y. App. filed May 1, 1916. Provides a system in which the overload protective device operates at substantially a constant percentage of overload, although, if desired, the character of the load itself may be changed with a consequent change of normal load current.

1,246,118. Incandescent Lamp; Irving Langmuir, Schenectady, N. Y. App. filed Sept. 4, 1913. Applies more particularly to lamps having filaments of refractory material such as tungsten.

1,246,165. Electrical-Resistance Material; Charles Ruzicka, Gravesend, England. App. filed May 16, 1914. Relates to electrical resistance materials made from a comminuted carbide-containing mixture whose essential ingredients have been bound together into a homogeneous mass.

1,246,210. Automatic Checker and Tally; George L. Woodward, Yonkers, N. Y. App. filed Aug. 10, 1915. Adapted to operate in connection with two-wheel and four-wheel trucks for tallying.

1,246,225. Portable Electric Light; Bernard Benedict, New York, N. Y. App. filed July 19, 1917. Improvements.

1,246,260. Winding Machine; John O. Goodwin, Akron, Ohio. App. filed Feb. 23, 1917. Is designed more especially for laying cord about an annular mandrel or core in the manufacture of cord carcasses for pneumatic tires.

1,246,282. Electrical Switch; Frank T. Kobayashi, Kenilworth, Utah. App. filed Jan. 17, 1916. An important purpose of the invention is to enable installation without the complication of structural details that characterizes fixtures ordinarily employed at present.

1,246,303. High-Tension Line Switch; Earle A. Muckey, San Francisco, Cal. App. filed March 26, 1917. Pole switches.

1,246,333. Fitting for Conduits for Electrical Conductors; Arthur W. Sclater, Westminster, London, England. App. filed Dec. 17, 1915. Improvements.

1,246,363. Magnet Switch; Theodore Varney, Pittsburgh, Pa. App. filed Aug. 12, 1912. Improvements.

1,246,380. Circuit Interrupter; Harold G. Baxter, Wilkinsburg, Pa. App. filed April 29, 1915. Applies particularly to contact members for the same.

1,246,417. Inclosed Fuse; Edwin H. Gilbert, Wilkinsburg, Pa. App. filed May 1, 1913. Renewable type.

1,246,422. Circuit Closer; Gerald M. Hart, Wilkes-Barre, Pa., and Lewis L. Evans, Bridgeport, Conn. App. filed Sept. 11, 1916. Improvements.

1,246,441. Metallic Terminal for Electrodes; George M. Little, Pittsburgh, Pa. App. filed Aug. 11, 1913. Arc lamp.

1,246,461. Strain Insulator; Bentley A. Plimpton, Victor, N. Y. App. filed June 28, 1917. Object of the improvement is to provide a cementless connection between an insulator section and a metal cap by means of a mechanical joint which does away with the necessity of a cementitious binder between the parts.

1,246,470. Barrier Seal; Edward E. Rose, Swissvale, Pa. App. filed Jan. 4, 1916. Improvement.

1,246,481. Insulator; Karl A. Simon, Edgewood Park, Pa. App. filed Dec. 9, 1916. Strain.

1,246,493. Pull Socket; George B. Thomas, Bridgeport, Conn. App. filed Dec. 18, 1915. Angle type.

1,246,533. Electric Lamp Support; Harry J. Bosworth, Chicago, Ill. App. filed April 26, 1917. Improvement.

1,246,602. Alternating-Current Dynamo-Electric Machine; Louis J. Hunt, Sandycroft, Wales. App. filed Dec. 10, 1915. Applies particularly to the secondary windings of such motors.

1,246,617. System of Distribution and Control; Benjamin G. Lamme, Pittsburgh, Pa. App. filed March 23, 1914. Has special reference to so-called "phase converters," which are employed for converting single-phase energy into polyphase energy for the operation of polyphase induction motors.

1,246,622. Electric Table Stove; Edwin N. Lightfoot, New York, N. Y. App. filed Oct. 4, 1916. Improvements.

1,246,623. Electric Elevator-Control System; Nils O. Lindstrom, Nutley, and Carl F. E. Olofson, Jersey City, N. J. App. filed Sept. 1, 1914. The provision of a system which, while the major changes of speed of the motor are controlled from the car, is semi-automatic in its operation to insure a gradual starting or stopping of the car under varying load conditions.

1,246,625. Multi-Contact Switching Device; Alben E. Lundell, New York, N. Y. App. filed Sept. 22, 1916. May be used as either a make-before-break or a break-before-make device, the change from one to the other being a very simple matter, in which the intervals before mentioned may readily and easily be changed without bending the contact springs.

1,246,643. Method of and Apparatus for Transmitting Power; Alfons H. Neuland, New York, N. Y. App. filed July 31, 1915. Improvements.

1,246,647. Lamp Support; Ralph D. Parker, San Francisco, Cal. App. filed Feb. 19, 1916. Improvements.

1,246,677. Plug and Receptacle; Hart A. Stoddard, Philadelphia, Pa. App. filed Jan. 16, 1914. Provides a receptacle comprising spaced resilient jaws and a plug having a member adapted to enter said jaws, said jaws and plug being provided with co-operating means for removably locking the latter in the former.

1,246,686. Apparatus for Protecting Electric Circuits; Kalman von Kando, Vado Ligure, Italy. App. filed Dec. 9, 1914. Provides an improved arrangement by means of which the influence of alternating currents on neighboring electric circuits (hereafter simply called circuits) is eliminated.

1,246,687. Remote Control for Electric Motors; Chalmers P. Wells, New York, N. Y. App. filed Oct. 22, 1914. Improvements.

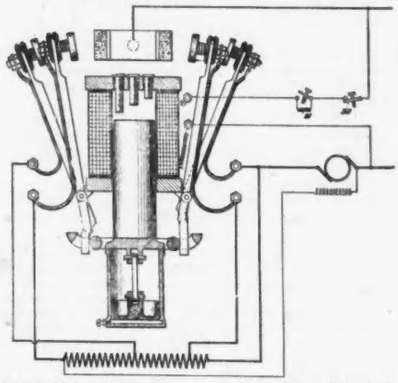
1,246,702. Rotary Converter; John B. Bassett, Schenectady, N. Y. App. filed Feb. 18, 1916. Particularly to rotary converters provided with commutating poles and operated in connection with boosters mechanically connected thereto, the field of the boosters being variable for the purpose of varying the ratio between the alternating-current and direct-current voltages.

1,246,711. Electric Fuse; Leonard B. Buchanan, Woburn, Mass. App. filed April 14, 1917. A type adapted to show conspicuously, by the displacement of an indicator element visible at the outside of the fuse, when the fuse is blown out.

1,246,712. Lightning Arrester; Frederick H. Burkhardt, Trenton, N. J. App. filed March 6, 1917. Improvements.

1,246,741. Switch-Box Stay; Samuel L. Hancock and John J. Ortner, Oakland, Cal. App. filed Sept. 27, 1916. Relates to a stay for switch boxes, an attachment used for installing and fastening a switch box in place.

1,246,767. Oil-Level Indicator; Jesse B. Knowles, Oakland, Cal. App. filed Nov. 1, 1916. Provided with electrical contacts so positioned that they will not be affected by sediment in the oil or by other foreign matters which may settle at the bottom of casing.



1,246,687—Remote Control for Electric Motors

1,246,792. Fuse Device; Edmund O. Schweitzer and Nicholas J. Conrad, Chicago, Ill. App. filed Dec. 31, 1914. Especially adapted for extra-high potentials.

1,246,810. Flame-Proof Insulation; Carleton Ellis, Montclair, N. J. App. filed July 2, 1917. Applies particularly to the use of chlorinated material of an organic nature, especially chlorinated wax.